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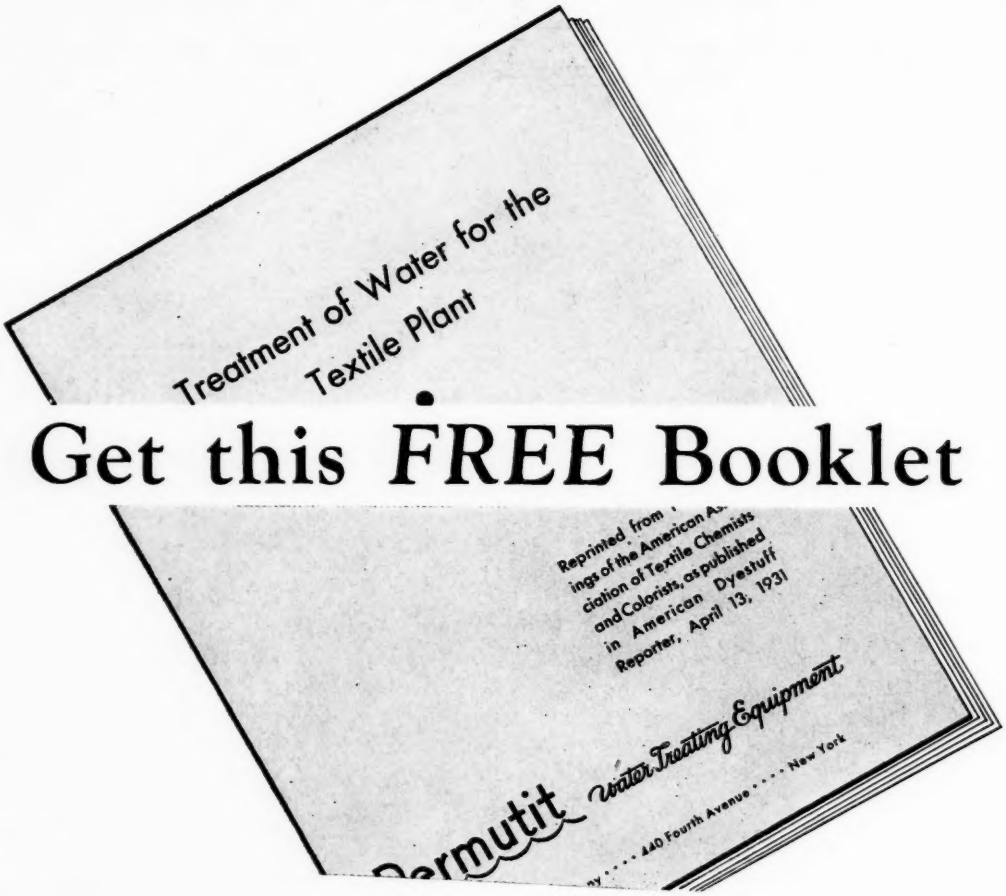
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The Lubrication of Textile Fibers

By ALAN A. CLAFLIN

Relatively little technical attention has been given the lubrication of textile fibers. In a textile lubricant, ease of removal is a prime factor, inasmuch as the lubricant must be removed after it has served its purpose. The difficulties encountered in removing the lubricant are obvious, whereas the determination of the lubricating power is difficult. This article is a general discussion of the subject of lubrication as applied to textile fibers.

IN ANY consideration of the processes of the textile industry, it should be recognized that it is an ancient art. Method and procedure have been developed in the long course of practical experience and it is the duty of the technician to examine them and determine how and in what degree they should be changed or modified to be consistent with present day scientific knowledge. Among textile processes toward which relatively little technical attention has been given is that of the lubrication of the fibers to facilitate the carding and combing processes, or specifically the oiling of wool, because only in a very minor degree are other fibers lubricated. It is possible that as lubrication is better understood that the other fibers will be more generally lubricated than they are today, because it is not so much that the processing of other fibers may not be helped by lubrication, but that the disadvantages outweigh the benefits. Indeed this consideration brings up one point that makes the lubrication of textile fibers different from almost any other form of lubrication, namely, that once the lubricant has performed its function, it must be removed and in a textile lubricant ease of removal is as important as lubricating properties. Perhaps it would seem nearer the truth to say that readiness of removal is the factor of greater importance, at least more attention has been given to that factor than to lubricating property, but the real reason for this is rather that lubricating power is difficult of determination, while difficulties of removal are extremely obvious.

Development of Wool Oiling

While wool carding was a hand operation, oiling the fiber was a very simple process, a small quantity of oil was sprinkled on the wool from a can or vessel with a small snout, or shaken on from a brush, and the hand carder could manipulate the wool to see the oil was properly spread. The nature of the oil was determined by the country and latitude. In the most northern latitude neatsfoot oil had a preference from its low cold test, but lard and olive oils had the widest use. In general the custom became established that lard oil was used on the shorter staple and cheaper wools and olive oil on the longer staple, fine combing wools. How much this distinction is due to a difference in lubricating properties of these two oils, and how much is due to the fact that the fine long stapled wools once came from Spain and the early manufacture come to England from Flanders long under Spanish domination, is not clear. Anyway this selection of oils, according to the nature of the wool, is older than carding by machinery.

In the choice of an oil for wool lubrication, there are two properties of the oil that must be considered, or perhaps it is more correct to say that in the oil are opposite forces and in the proper balance of these forces rests the suitability of the oil. These forces are viscosity on which the true lubrication depends and what for want of a better term may be called "spreadability," the tendency or force that makes the oil wet or distribute itself over the fiber. Viscosity may be defined as the evidence or degree of mutual attraction of the molecules of a liquid. It is this attraction which makes all liquids when free of external forces assume the spherical form. Surface tension, a term frequently used but not so often understood is the amount of work that is required to overcome this tendency of liquids to assume the spherical form. Since the purpose of lubrication is to prevent injurious surface contacts, metal on metal, or in textile practice metal on fiber surface, the stronger the internal attraction, the more resistent to disruptive influences, the better the lubrication.

On the other hand, the greater the viscosity the less the tendency to spread on one or both surfaces and unless there is surface covering there cannot be lubrication. While surface tension is the exclusive property of the liquid itself, in relation to other surfaces or other liquids, there is another property involved termed polarity, which determines the placing or orientation of the molecules and such orientation affects or modifies the behavior of the liquid toward surfaces and other liquids in which it is insoluble. To express it perhaps more simply, interfacial tension is modified by the polarity of a liquid, and the spreading ability of liquid on a surface is in inverse ratio to the interfacial tension. A liquid that has a positive or negative group that is an acid or basic substance, is a polar liquid.

Influence of Polarity

To go back then to the oils that are used for oiling wool, it has been learned by experience that a certain quantity of free fatty acid is desirable. In the case of the olive oils that are preferred for oiling combing wools, it is the general experience that such an oil should contain from five to seven per cent free fatty acid. Oftentimes the importance of this percentage of free fatty acid is not understood by practical men and they will specify the use of oils of particular brands or from particular district or ports, but on analysis it will be found that the desired oils have the stated percentage of fatty acid. In such an oil the neutral oil provides the viscosity and the fatty acid the "spreadability." With the short fibered felting wools, and the reworked wool stocks, it is necessary to use a higher percentage of oil than for combing wools, and likewise because of long fulling operations the removal of lubricating oil is not likely to be, or should not be a troublesome problem. Since an excess quantity will not prove objectionable or may even be profitable if the wool is sold before the oil is removed, as is particularly apt to be the case with reworked wool stocks, the cost of wool oil is an increasingly important factor.

Possibilities of Petroleum Oils

The desire to reduce the cost of wool oils rather than the consideration that petroleum oils might have valuable physical properties that fitted them for wool lubricating agents, undoubtedly has been the influence to their general introduction. Indeed it has been rather characteristic of the introduction of petroleum lubricating oils for all purposes that they have come in by the side door rather than the front. Today pure Pennsylvania, is the proud claim of the manufacturer of automobile lubricants, but forty years ago pure Sperm was the claim of the lubricating oil merchant, and it is true in many instances today that animal and vegetable oils are used to extend the viscosity of claimed pure petroleum oils, as it was in the old days to extend the Sperm oil with mineral oil. There is trouble arising from using oils because of their source rather than understanding the essential properties and using the cheapest oil that provides those properties. Now when it became apparent that a certain quantity of mineral oil or non-saponifiable oil might be used, objection was raised and the claim made that such oils were injurious because they could not be removed by saponification. Mention is made here of non-saponifiable oils other than petroleum oils because distilled oleines, that is, oils distilled from recovered wool grease and which contain a high percentage of unsaponifiable oil, were perhaps the first of the non-saponifiable oils to be used extensively in oiling wool. However, non-saponifiability was considered an objection and it was not appreciated that even pure olive oil is not removed from worsted by saponification, about all the saponification that takes places is the combination of alkali with the free fatty acid and the soap thus formed with or without additional soap, added to the scouring bath removes the oil by emulsification and not by saponification. In order to prove these non-saponifiable oils could be removed by emulsification, they were offered to the trade in the form of heavy emulsions or cream. Practical trial proved that many of these emulsions did as good as or better lubrication than a straight animal or vegetable oil, yet analysis showed they contained rather less than fifty per cent oil and of that oil only thirty to forty per cent was saponifiable.

Emulsions an Improvement in the Art

While many chemists condemned the use of emulsions as expensive, nevertheless it was gradually recognized that the introduction of emulsions was a step forward in the art. Water was replacing a certain part of the oil used in lubrication and equal results obtained. If the vendor of emulsions could make emulsions that would produce this result, why wasit not possible for the wool manufacturer to make his own emulsions, that it was and that as an emulsion is the most economical and efficient method of applying oil to short fibers, is generally recognized. It is probably just as true for worsted manufacture, but the relative economic importance of oiling combing wools is not as great as with the felting wools as already stated, result, why was it not possible for the wool manufacturer and more hazard in experiment. It is possible to use less actual oil in the emulsion form because with a straight oil part of the oil is used merely to convey another fat of the oil to where it is useful. In order to wet all the wool a certain minimum volume of liquid is necessary, part of this liquid may be water instead of oil, particularly is this true if the fiber is preferentially wet by oil. Not too much is known of preferential wetting, and certain observations are inconsistent with other observations, but it is highly probable that questions of polarity are involved. When commercial emulsions were offered for wool lubrication, it is obvious that such emulsions must be reasonably permanent, otherwise they would not last between time of purchase and time of application, this has led to the erroneous assumption that a permanency of emulsion is desirable for oiling wool, when the contrary is true, that is, while it is in the emulsified form, oil does not lubricate,

and it is necessary for lubrication to have the fiber break the emulsion, cause the oil globule to disrupt and deposit as a film on the fiber. If the emulsion is of such permanent character that despite the presence of the wool fiber it stays in an emulsion, it is evident it cannot lubricate as it is as an emulsion that it leaves the fiber in the scouring process. This is the objection to emulsions that are too permanent from the nature of their constituents and to the self emulsifying oils.

Self Emulsifying Oils

When the wool manufacturers became too enlightened to buy wool oils in the form of emulsions and at the same time had had their prejudices against non-saponifiable oils largely removed, the oil specialists offered self emulsifying oils, or oils that only require to be added to water containing a little alkali to completely emulsify. Now a proper wool oil should emulsify in the presence of alkali, that is, there must be sufficient free fatty acid present to form a soap that will act as an emulsifying agent and emulsify the remainder of the oil. There is, however, no particular point in having this alkali incorporated in the oil, this really means there is just so much less oil or so much non-lubricant and it is highly probable that this non-lubricant is so powerful an emulsifying agent that it will tend to maintain the emulsion and prevent deposition on the lubricating fiber. Yet there is always something mysterious and attractive to many practical men in an oil that when poured into water forms a fine white emulsion instead of separating as an oil film or layer on the surface. The observation that oil and water will not mix, is proverbial and the contrary phenomena is intriguing. Really this mixing of oil and water is of very familiar occurrence, e.g., whenever a mechanic washes his hands, oil is emulsified by the action of soap. In a self emulsifying oil the soap is merely dissolved in the oil. This requires a judicious selection or preparation of the soap, as all soaps are not soluble in oil. Anhydrous potash soaps are, however, soluble in an excess of fatty acid, and this solution is then soluble in oil. The most popular method of preparing such soaps is to dissolve a fairly pure caustic potash in alcohol and use sufficient of this alcoholic potash to half neutralize oleic acid (Red oil). This makes a clear solution and fifteen per cent of such a solution added to a mineral oil or a mixture of mineral oil and lard oil will make a self emulsifying oil. Such oils are also used largely in machine shop practice as cutting oils. Instead of alcoholic potash recently tri ethanolamine has been widely recommended as its soaps are likewise soluble in excess fatty acids. Probably alcoholic ammonia, made by passing ammonia gas into alcohol would be equally efficacious. However, as when the mechanic washes his hands, the oil and grease tends to stay in the water in the emulsified condition, so with a self-emulsifying oil, only as the water evaporates will the oil tend to separate onto the fiber and much will probably remain in an emulsified condition, and in this state it is not an efficient lubricating agent.

Modern Mechanical Emulsification

Better practice is to take advantage of the modern means of mechanical emulsification such as a Gaulin Homogenizer, or Premier Colloid Mill, or Hinckley Emulsifier. By these mechanical devices the oil is dispersed into such tiny globules that recoalescence is prevented by a very small percentage of emulsifying agent. Such emulsions distribute themselves as freely as a homogeneous liquid, yet in contact with the fiber the globules break and deposit a minute oil film, and a minimum of oil performs a maximum of lubrication. Whatever means of dispersing into an emulsion is selected the character or quality of oil is important. There must be sufficient viscosity to permit proper lubrication and there must be sufficient fatty acid to furnish spreadability or thinness of oil film.

Sulphonated Compounds as Emulsified

In place of oil soluble soaps in self emulsifying oils, the salts of a variety of sulphonated fatty acids or organic compounds may be used. In general principles the action of such compounds is probably not different from the action of soap as an emulsifying agent. There is a certain mutual solubility in both oil and water and polarity which produces orientation of the molecule or molecular aggregate in the interfacial zone. The sulphonated compounds are as a rule more soluble in both oil and water than the soaps, probably one or both solutions are somewhat of the nature of colloidal dispersions rather than true solutions, but in this respect the colloidal nature is generally greater with soap than with the sulphonated products. While this type of sulphonated emulsifying agent will undoubtedly tend to increase in the future, as modern methods of petroleum refining produce by-products of the napthene class that are readily sulphonated, it is doubtful as already stated if self emulsification is a desirable property in a wool oil as it tends to maintain the oil in the globule or emulsified form rather than as a film which latter condition is essential for efficient lubrication. The emulsified condition on the other hand is without question more conducive to economical and thorough distribution. The very fine mechanical emulsions permeate the mass of wool fibers almost as freely as pure water, but if the proper, or perhaps one should say, a minimum of emulsifying agent is used, the globules will break in contact with fiber and form a surface film.

With Fine Emulsions More Water May Be Used

With a fine emulsion it is also possible to use a greater proportion of water to oil, and this tends to greater economy. In self-emulsifying oils if the proportion of emulsifying agent is toward the lower limit, greater dilution will tend to produce separation or breaking of the emulsion, and while breaking by the attraction of the film is desirable, breaking by dilution means uneven distribution. The quantity of oil it is necessary to use for proper lubrication depends both on the nature of the stock and the nature of the oil. As a general rule it may be stated that the lower quality stock, the greater the quantity of oil

required, but as the lower quality of the stock generally the lower the quality of oil, it is not so obvious that some of the greater quantity of oil may not be due to its lower quality. No standard has been established as to the requirements of viscosity for lubrication, indeed to the practical man in the industry there is apt to be a confusion between viscosity and tackiness and wool carders will be found who claim they wish no viscosity in their wool oils. Probably more information can be obtained in regard to viscosity by considering the viscosity of oils that are admittedly satisfactory and then the viscosity of cheaper substitutes. An Extra No. 1 Lard Oil and a good quality Denatured Olive Oil have approximately the same viscosity, somewhat above 200″ at 100° F. with a Saybolt Viscosimeter. An "Off Prime" or Winter Strained Lard Oil has quite a little higher viscosity and 30 Cold Test Neatfoot Oil still higher up to 260″-270″. As the percentage of free fatty acids increase, the viscosity goes down, and that it is not necessary to have so high viscosity as in the better grades of lard oil or olive oil, is indicated by the free use of Red Oil (commercial oleic acid) as a wool lubricant. An average Red Oil has a viscosity below 150″, but probably there is more objection to Red Oil because of its corrosive action on the cards than its lack of lubricating quality due to low viscosity. The purpose, of course, in the use of Red Oil is its ease of removal, that it saponifies more quickly than a glyceride is certainly true, but often neither when Red Oil or Lard or Olive Oil is used is there as much alkali used in scouring as would be required for a complete saponification, the larger portion of oil is removed by dispersion. Red Oil undoubtedly has a greater "spreadability" than other oils and this is one reason for favoring its use. To further cheapen a wool oil, considerable amounts of petroleum oils are used, and because the use of such has come in more or less by the side door, the quality and properties of such oils have not been sufficiently considered.

Wool Stock Oil Felicitous Term for Petroleum

In fact, it is not exactly "de rigueur" to speak of petroleum or mineral oils in connection with oiling wool, the trade term for such oils is "Wool Stock." Presumably there is a feeling that a felicitous name may keep the dyer or finisher from fear that the stock would not scour if it were oiled with anything pertaining to petroleum. Not how much "Wool Stock" oil may be used is not definitely settled, but the tendency is to use increasing amounts and certainly more is used in this country than is used abroad or recommended by authorities abroad.

It is not at all certain, however, that more is not used abroad than is stated by authorities, certainly the distilled oleins with large percentages of unsaponifiable matter are freely used, but even so great an authority as Levkowitsch[1] advises against use of any non-saponifiable oils. Other authorities as Bennett[2] suggest that up to thirty per cent may be used. In America probably eighty per cent is about the upper limit and this is used only on reworked stock, and for this perhaps seventy per cent is considered better. A typical shoddy oil is made of seventy per cent Wool Stock, fifteen per cent each of No. 1 Lard Oil and good quality distilled Red Oil. Some manufacturers increase the quantity of Red Oil at the expense of the lard oil and some do just the reverse. Increase the Lard Oil increases the viscosity but lessens the "spreadability"—it probably very slightly affects the scourability, although that is the reason usually given for increasing the proportion of Red Oil. With new wool and of the better grades, sixty per cent seems to be about the upper limit for Wool Stock and opinions are about as varied as with reworked wools as to the proportion of Red Oil and Lard Oil in the other forty per cent. In regard to the quality of the Wool Stock itself, while freeness from any tendency to gum has been considered a fundamental specification, and in the present state of oil refining this is rather an obsolete specification, the more important property of viscosity has been neglected. One finds Wool Stock oils with as low as 80″ viscosity when for a few cents more per gallon 100″ or 120″ oils are available, and the use of these higher viscosity oils would undoubtedly lessen the quantity of total oil and ratio of lard oil required for lubrication. On the long stapled wools there has been little change from the practice of considering olive oil of a certain degree of acidity or rancidity the only proper lubricant, except in the case of the coarser carpet wools where lard oil emulsions are widely used. At the present time the price of olive oil is so low that there is not the incentive to experiment with substitutes that there is in times of short olive crops, and in recent years the increasing production of olive oil in Northern Africa has tended to keep prices downward, for the sake of technical advance the special necessity for olive oil in this ranch of the industry should be considered. Often times in periods of high priced olive oil, much cotton seed, rape seed and peanut oil have been used as adulterants, and the trouble with these is reported as more due to their drying qualities, or oxygen absorbing properties that make the oil heat on storage and eventually cause spontaneous combustion, than failure in the lubricating. The lubrication of combing wools is not relatively as important as with the shorter staple wools, both because the value of the staple in proportion to the oil is greater and the actual quantity required is less, but in the interest of technical progress and thorough understanding of the art, if not for immediate pecuniary reward, it would seem worth while to investigate the necessity of olive oil for worsted lubrication. One attempt in modifying the procedure has been the entire replacement of oil by hydroscopic substances, such as glycerine, ethylene glycol, di ethylene glycol and sodium lactate. While all these substances have viscosity, there is some question whether the lubrication given by them is the same as given by an oil, as some modern phycisists might express it, the angle of contact between the liquid and solid surface is too acute. How extensive has been the experience with hygroscopic substances in lubricating combing wools is not generally known, and it is likely the objection as voiced

(Continued on Page 643)

Maintenance of Relative Humidities On A Laboratory Scale

By **WILLIAM G. CHACE**
Instructor in Chemistry and Microbiology, Lowell Textile Institute

In this article the author gives two methods of maintaining small samples at definite humidities. Both methods allow of continuous variation of the relative humidity. Tables and graphs are given by which the proper concentration of the solutions for any degree of humidity may be determined. A humidity box is described which may be used as a substitute for a conditioning room. Advantages and disadvantages of the solution mentioned are discussed.

THE worker in textiles or other hygroscopic substances often has to carry on tests or reactions under conditions of controlled humidity. Most laboratories where such work is carried on are equipped to maintain humidity at some standard conditions under which most tests are carried out. If, however, work is to be undertaken at other humidity conditions, it is up to the worker to make some other arrangements for maintaining these relations.

It may be well to review just what is meant by relative humidity at any temperature. Relative humidity is often defined as the amount of water vapor in the air divided by the amount which would be present if the air were saturated at the same temperature. A more accurate definition is the following: relative humidity is the pressure of the water vapor in the air divided by the pressure of saturated water vapor at the same temperature.

$$RH = \frac{p}{p^\circ}$$

Where RH = % relative humidity
p = actual vapor pressure water vapor
p° = saturated vapor pressure water

Certain conditions of humidity can be realized on a small scale by working over crystalized salts which have definite vapor pressures of their water of crystalization. The dessicator with calcium chloride in the base is an example of this. The vapor pressure of this salt is so low that a practically dry atmosphere is maintained. While this method is valuable in certain cases, no variation of the conditions is possible and therefore its application is limited. What is needed is a continuously variable vapor pressure. Since dissolving non-volatile substances in a liquid lowers the vapor pressure, it remains only to find some non-volatile substance which is infinitely soluble in water to have an ideal arrangement for controlling humidity. Many substances might be used, but for ordinary purposes sulfuric acid seems to meet every requirement. The amount of water which evaporates from a sulfuric acid solution varies with the percentage of the acid solution from a maximum at 100% water to none at 100% acid. Sulfuric acid has the further advantage that it is almost universally available and is easily diluted into solutions of known concentrations. Its determination in cases where analysis is necessary is also very simple as almost every laboratory is equipped to carry out acid titrations. Wilson[1] was the first to point out the advantages of this method of maintaining any desired relative humidity. He gives a graph and the thermodynamic theory behind the calculations.

Calculation of Pressure of Water Vapor

In order to calculate the pressure of the water vapor which must be maintained to give any degree of relative humidity, it is only necessary to find the saturation pressure of water vapor at the temperature in question and to multiply by the relative humidity expressed as a decimal. By this means a table was obtained showing vapor pressures at different humidities. Greenwalt[2] gives data from which a graph of the vapor pressure vs. per cent sulfuric acid was drawn and from this a table of humidities corresponding to various strengths of sulfuric acid was prepared. This table is reproduced below (Table I). The vapor pressure corresponding to different degrees of relative humidity at 20° C. are included. The graph (Figure 1) was drawn from the table.

Relations at Various Temperatures

Calculating the relations at various temperatures and plotting the curves on the same axes shows us that the relative humidity over any concentration of sulfuric acid is practically independent of the temperature. This fact was also pointed out by Wilson[1]. This is so because the saturated vapor pressure and the pressure over sulfuric acid both vary at the same rate, hence the ratio remains the same. While there are slight actual variations, especially near the saturation point and near 0% RH, the results within the ranges usually employed in textile work and around room temperatures, will be found much better than are maintained by the best conditioning rooms. The worker wishing to employ any given relative humidity has only to prepare a solution of sulfuric acid of the proper concentration, as given in the tables or found from the graph, and suspend his work in a closed vessel over the acid and he will have the conditions desired. For example, suppose it is desired to produce an atmosphere having a relative humidity of 55%. From the graph it is found

that a 41% sulfuric acid solution gives 55% humidity. By preparing a 41% sulfuric acid solution and placing it in the bottom of a dessicator, anything placed in this dessicator will be maintained at these conditions. The curve (Fig. 1) may be used for rough work or the following equation calculated by the method of least squares, may be used for values between 15% and 75% RH:

$$RH = 67.5 - 0.476A$$

Where A = % sulfuric acid

Interpolation or a more accurate graph prepared from Table I must be used for exact work.

TABLE I

% Rel. Humidity	Pressure of Water Vapor mm of Hg	% Sulfuric Acid
0		100
5	0.876	69.0
10	1.754	64.0
15	2.629	61.0
20	3.507	57.7
25	4.384	55.2
30	5.261	52.5
35	6.137	50.3
40	7.014	48.0
45	7.891	46.0
50	8.768	43.9
55	9.644	41.5
60	10.521	38.6
65	11.498	35.9
70	12.275	33.7
75	13.151	30.8
80	14.028	27.1
85	14.905	22.5
90	15.782	16.4
95	16.658	9.8
100	17.535	0.0

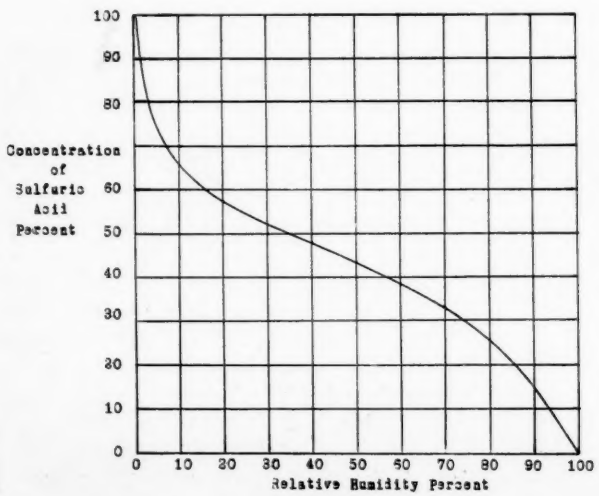

Figure 1

Temperature Corrections

It must be realized that although the relative humidity in such an arrangement is independent of the temperature, the hygroscopic properties of the materials will without doubt be seriously affected by changes in temperature. Therefore, the whole apparatus must be kept at constant temperature if accuracy is aimed at. This is an important consideration and must not be neglected. Where corrections for temperature must be made, the following relation originally pointed out by Hathorn and given by Matthews[3] may be used:

$$R = k - \frac{1}{T}$$

Where R = regain

T = absolute temperature

This relation is valid only for unbleached cotton.

Further Corrections

For very accurate work a further refinement must be added. Since the material will probably not be introduced into the humidifier at the moisture content desired, it must be borne in mind that the water which passes into or out of the material comes fromor goes into the acid solution thereby changing its concentration. In any case, care should be taken to introduce the sample in as near its final state of regain as possible, and to use as large a volume of acid solution as possible. Where extreme accuracy is aimed at or where it is necessary to use a small volume of humidifying solution, it will be necessary to titrate the acid after equilibrium is reached and correct for any significant changes in acid concentration.

Use of Other Solutions

The data given above will be found satisfactory for all work unless it must be left in the humidifier a long time. Under these conditions it has been found that the sulfuric acid fumes tender the cloth. It has also been found by Armstead and Howland[4] that molds will not grow in an atmosphere humidified by sulfuric acid solutions. These latter report excellent results using solutions of phosphoric acid. Unfortunately they do not give data from which suitable solutions may be reproduced. Some work has been done in the laboratories of the Lowell Textile Institute by the author and his students to determine the necessary concentrations, but sufficient data has not yet been collected to warrent publication. It is hoped that this may be presented in the near future.

Barr[5] recommends a solution of calcium chloride for humidifying where long exposures are necessary. His data was taken from the vapor pressure determinations of Paranjpé[6]. It is reproduced in Table II and shown graphically in Figure 2. While these solutions are not as easy to analyze as sulfuric acid solutions, they may be approximately determined by density measurements. It will be noted that Table II gives the data in terms of specific gravity. Table III gives the same data in terms of degrees Twaddle, as this scale is more often used by the textile chemist than the former. The precautions noted

TABLE II

% Relative Humidity	Specific Gravity Calcium Chloride Solution — 15°/4°
40	1.395
50	1.349
60	1.302
70	1.252
80	1.195
90	1.121
100	0.999

TABLE III

% Relative Humidity	Density Calcium Chloride Solutions, Degrees Twaddle
40	79.0
50	69.8
60	60.4
70	50.4
80	39.0
90	24.2
100	00.0

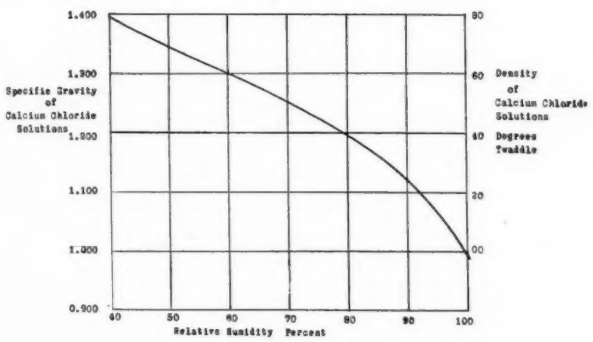

Figure 2

under sulfuric acid hold equally here, viz., large volume of solution, or if this is impossible, measurement of the concentration at the time the sample is removed. The temperature relations are the same as for the acid; relative humidity independent of temperature, but regain affected by changes of temperature. A serious drawback to the universal use of calcium chloride solutions is that they cannot be employed to give relative humidities less than 40%.

Barr[5] finds it possible to dispense with a conditioning room and still do accurate testing by using a large wooden box (3 feet on a side) containing in the base, a tray of calcium chloride solution of the proper strength. He adds a small electric fan in order to keep the air uniform throughout this large volume. Wet and dry bulb thermometers were added so that the humidity might be read directly. If these are correctly placed in relation to the fan, there is sufficient movement of air past the wet bulb to permit the use of the more accurate psychrometric tables.

By use of one or both of the methods given above, the laboratory worker will be able to maintain his samples at any degree of humidity with an accuracy better than is required in textile work. By constructing a humidity box similar to the one described, the laboratory without a conditioning room may carry out tests under conditions of controlled humidity.

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Scientific Research the Only Sound Insurance Against Industrial Over-Capacity

"THE only sound insurance against over-capacity, and 'industry obsolescence' is a soundly conceived, systematically conducted, and properly controlled research policy directed at the development of new products and the improvement of processes." This was the assertion of Prof. Robert F. Elder, Division of Business and Engineering Administration at M. I. T., in an address at the afternoon session, last June, at M. I. T., Cambridge, Mass., of the Board of Directors of U. S. Institute for Textile Research, which, in addition to reports of scientific research in progress and projected, was devoted to a discussion of the subject "What Is Being Done, and What Can Be Done, in the Field of Distribution Research in the Textile Industry."

"The job expected of market research in the past," stated Prof. Elder, in elaborating his subject of "Coordination of Technical and Market Research," "has been the finding of customers for goods which have been produced, both as to quantity and quality, in accordance with plant facilities and past experience. The jobs of technical and scientific research have been in a large measure to improve manufacturing methods and processes in order to reduce costs, and hence earn a profit in the face of enforced decline in price.

"In this age of change, probably the only satisfactory solution of the problem of excess capacity which confronts most industries is the adaptation of both kind and quantity of goods produced to the needs of the consuming public. This means limiting the production of existing goods to the quantities which can be profitably sold, and developing new products to take up the slack in productive capacity."

Cleansing Agents and Water Treatment*

Chemical Knowledge and Numerous Chemicals Necessary to Success of Cleaning and Water Control

By **H. O. MORAW**
Chemical Division

More than $700,000,000 is paid annually to commercial laundries, dyeing and cleaning establishments by the American public in its desire to keep clean. Likewise there are numerous commercial enterprises such as cleaning of metals before finishing of metal products, exterior cleaning of large office and public buildings, and the dairy, canning, soft drink, soda fountain and brewery industries with their washing and equipment cleaning requisites. These industries all offer a market for cleansing materials at home and abroad, while water purification and clarification is an important related phase.

SOAP and water, the most widely used cleaning chemicals are being supplemented everyplace with numerous other cleaning chemicals. The water in numerous places is a carrier of material which impairs its value as a cleansing or industrial processing agent. Consequently chemical and physical pretreatment of water supplies are extensively practised. Moreover chemical cleaning operations without water are manifold.

The rapid growth of the world textile industry with the keener competition resulting from uniformly higher quality products; the spread of dry-cleaning, dyeing and power laundry service; as well as use of mechanical household washing machines, all are producing a cumulative effect in commercial trade circles. These newer developments are forcing keener study of the needs for and the effects of chemical cleaning agents and methods. Modern water systems, plumbing and bathing facilities have been developing hand in hand with water clarification and sterilization methods.

As the value of these various services penetrates the social and commercial structure of foreign countries, power laundries, dry-cleaning plants, textile processing mills, municipal water systems and the like are established. These frequently require importation of the supplies including chemicals for their maintenance such as chlorine, alum, bleaches, solvents, ammonia, caustic soda, caustic potash, a trade in which the U. S. shares.

Prominent among the United States exports of chemicals of which a large proportion is utilized for cleaning operations and water treatment are: some 30,000 tons of sodium silicate, 80,000 tons of borax, 6,500 tons of sal soda, 35,000 tons of soda ash, 60,000 tons of caustic soda, 25,000 tons of aluminum sulphate, 200 tons of lye, 2,500 tons of bleaching powder, 1,600 tons of water softeners and boiler compounds, 5,900 tons of scouring powders, and pastes, 20,000 tons of laundry soaps and 57,000 pound of bath salts.

Details of the exports of each of these products cannot be supplied in this article but it is of interest to note the chief buyers of two of the groups in 1929. In the water softeners group, for example, the largest sales were made to Argentina $275,458, Chile $26,173, Canada $18,838, Mexico $10,831, Peru $7,163, Spain $5,825, Uruguay $5,698, Cuba $4,059. The principal buyers of scouring soaps and powders included Canada $145,595, Australia $69,563, Cuba $80,177, Union of South Africa $28,741, Chile $27,449, Mexico $28,774, Sweden $24,717, New Zealand $24,809, Argentina $21,920, Brazil $20,695. Sales of varying lesser amounts were made to 70 other countries.

Cleaning Industry Favored by Depression

According to the manager of the National Association of Dyers and Cleaners, the school for training craftsmen in the art of cleaning recently experienced difficulty in supplying sufficient skilled workers because of the heavy demands by the industry. This was attributed to increased demand for cleaning service due to lower prices and recognition by the unemployed of the desirability of keeping up appearances in applying for jobs.

The above organization estimated that there were about 7,000 dry-cleaning plants operating in the United States employing 100,000 workers, although a smaller number of both are shown in the accompanying table of the Bureau of Census figures on cleaning plants, the differences being due probably to the inclusion of cleaning units operated by power laundries. The following table shows the official figures for these lines of direct consumer service as well as the total production of the related soap industry.

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* Department of Commerce Report.

1929 Census of Commercial Power Laundries, Dyeing and Cleaning and Soap Plants

(Establishments operated by Mechanical Power, reporting receipts of $5,000 or more.)

	Dyeing and Cleaning	Laundries	Dyeing and Finishing Textiles	Soap Industry
Number of establishments	5,296	6,216	656	274
Wage Earners	59,283	220,706	69,643	14,050
Wages	$75,832,734	$214,999,515	$ 83,738,948	$ 18,620,690
Cost of Supplies, fuel, electric power	$26,858,912	$ 75,552,579	$217,593,429	$174,772,304
Value of service or Total Products	$201,255,460	$509,854,373	$408,702,685	$303,377,358

Diversity of Cleaning Products and Their Uses

In general the diversity of chemical products used for cleaning is about as varied as the cleaning problems. In the absence of data showing the extent of the trade in all the different chemicals used only a few of the more prominent products used for cleaning and the chemical raw materials from which they are made are discussed here. Details may be procured from the Bureau of Standards Circular No. 383[1] "Washing, Cleaning and Polishing Materials," whose author, F. W. Smither, extended a cooperative review of this article.

The dry cleaning soaps also known as "benzine soaps," which dissolve in cleaners' solvents are usually made from oleic acid and caustic potash or soda, or a mixture of the two. Ammonia is frequently used in making dry cleaning soaps. Triethenolamine is a recently developed American product, capable of forming soaps soluble both in water and in dry cleaning solvents, and of emulsifying mineral oils. These properties and its suitability as a reagent for various industrial purposes give it a rather wide potential market. In addition to these chemicals the hydrogen and oxygen gases liberated in the electrolytic cleaning of metals aid in the mechanical removal of the dirt.

Sodium silicate is used to sustain the detergent action or properties of soap solutions; alkaline solutions and resin soaps to promote free rinsing; alkaline cleaners with soap solutions to provide a colloidal action. Soap free alkaline cleaners containing finely divided materials such as silica and alumina may exert a scouring action or imitate the colloidal action of the soap. Coming within the latter category should be included products called colloidal cleaning powders, which are composed of causticized starch or cellulose matter; or certain colloidal clays mixed with such substances as soda ash, trisodium phosphate, washing soda, borax, and soap. Certain silicates of soda and sodium aluminum silicate may be used alone as colloidal cleaners.

Much progress has been made by scientific, commercial and government research institutions in developing dry cleaning solvents. In addition to the well known cleaners naphtha one of the most recent developments was a special petroleum distillate for a dry cleaning solvent which reduces the fire hazard and at the same time is a solvent free from the ingredients which formerly were responsible for the objectionable odors remaining in garments after being dry cleaned. Approximately 30,000,000 gallons of this solvent, known as "Stoddard Solvent" are used annually by the dry cleaning industry, of which a substantial part is recovered and re-used. Recent developments of dry cleaning equipment for home and industrial purposes, designed for use with these low fire hazard solvents such as the above and carbon tetrachloride and trichloroethylene and the like, promise greater economies for commercial dry cleaning and expansion of consumer use of this important service.

The economic advantages of recovering solvents both in the dry-cleaning and chemical industries have increased the outlets for precipitating agents; and for absorbent materials such as powdered activated charcoal, silica-gel, silica, and diatomaceous earth in addition to filtering materials for removal of odors, colors, etc., not removed by distillation.

Laundry Chemicals

The laundry chemicals used are bleaching agents—chlorine, chlorinated lime and soda, peroxide, perborates, permanganate, ozone, sodium bisulphite and oxalic acid; sours include:—acetic acid, sodium bisulphite, oxalic acid, sodium bifluoride, and sodium silico-fluoride. Sodium bicarbonate and calcium chloride are used in rinsing clothes to obviate damage from residual chemical sours or "winter damage" from fumes in the atmosphere. In addition to these there are bluings including indigo, soluble Prussian blue, ultramarine and blue aniline dyes, with an annual production value exceeding $1,000,000.

Distinct from the Garment dyeing and cleaning industry is the Dyeing and Finishing Textile Industry reporting separately to the Bureau of Census as a group which consumed in 1929 over $217,000,000 of materials chiefly chemicals and dyestuffs. This figure is exclusive of those textile mills which perform their own dyeing and finishing and do not report them separately.

Boiler Compounds and Water Softeners

Hard water containing dissolved mineral salts causes great private and industrial inconvenience, soap losses, and fuel waste. With waters in some regions one-half to two-thirds of the soap used is wasted, because it is over and above the quantity required to do the cleaning itself, and could largely be saved by chemical pretreatment. Information on the condition of water for industrial use is available from the United States Geological Survey, Washington, D. C. Much of the expense and inconvenience of cleaning clogged drain pipes may be eliminated

by use of drain cleaners which may contain caustic potash or soda alkali and aluminum turnings.

Unofficial estimates place the quantity of aluminum sulphate used annually for water treatment at 200,000 tons, and soda ash in excess of 100,000 tons. Some of the other principal water treatment chemicals are lime-barium carbonate, sodium and barium alumnates, sodium aluminum silicate (zeolite), ferric alumina, sulphur dioxide, ammonia, copper sulphate, chlorine and salt. Although consumption figures are not available considerable quantities of these products are used for household and industrial water softening in small automatic equipment as might be deduced from the sales of the latter which are shown in the accompanying table.

UNITED STATES PRODUCTION OF BOILER COMPOUNDS, CLEANERS, ETC.

	Boiler Compounds	Cleaning Preparations	Soap Powders		Household Ammonia
	(Cleansing powders, scouring and washing powders.)				
	Value	Value	Short Tons	Value	Value
1921	....$3,622,352				
1923	 4,889,270	$20,119,354			
1925	 5,756,729	24,876,649	273,993	$24,858,113	$1,848,198
1927	 5,867,285	32,262,813	263,226	26,909,511	1,249,117
1929	 4,904,866	43,625,055	226,362	25,622,421	981,551

UNITED STATES SALES OF DOMESTIC WATER SOFTENING APPARATUS

	Number Units	Net Sale Price	Average Value Per Unit
1928	16,189	$1,903,587	$117.69
1929	15,963	1,848,396	115.79
1930	11,783	1,495,247	126.00
1931 (6 mos.)	4,457	529,497	118.80

Unnecessary waste of fuel may result from deposits in boilers of lime and magnesium compounds which accur in hard waters. Investigations[2] by the Bureau of Mines showed losses of efficiency due to boiler scale varying from one-fiftieth to one-ninth of an inch in thickness, range from 9 to 16 per cent. Estimates from this study showed that probably 15,000,000 tons or more of coal annually could be saved by elimination of hard water for locomotive boilers alone. For example, one of the large railroads of the country utilizing soft water was reported to be saving at least $75,000 annually; a steel company with an annual output of 50,000 tons, reported the saving of 200 pounds of coal per ton of steel. While according to The American Railway Engineering Association, an unofficial source, every pound of scale kept out of boilers saves the railroad company about 13 cents, the equivalent of a substantial sum annually. In addition to the removal of scale forming solids, it is of the greatest importance to railroads to remove corroding ingredients in water, especially oxygen. One authority indicated that it costs approximately $2,000 to replace a set of boiler tubes in a modern locomotive and some waters are so corrosive under the high temperatures and pressures prevailing in locomotive boilers that new tubes would be required in six months without chemical treatment.

INDUSTRIAL APPLICATIONS OF CHEMICALS IN WATER TREATMENT OR CLEANING

Boiler and pipe deterioration due to dissolved oxygen, carbon dioxide, common salt, magnesium chloride in the water supplies are prevented or reduced by various means; i.e., gases are removed by chemical reagents (deactivation) or deaeration, a physical means; protective films may be formed inside pipes by use of sodium silicate; alkalies are used to counteract acid.

Few industrials have so quickly and widely recognized the necessity of good water as the textile industry. The leaders in this industry have long practiced the removal from their water supplies of coloring matter, suspended solids, dissolved minerals and employ various chemicals appropriate for absorbents, sedimentation, softening and the like with the necessary chemical engineering supervision. Moreover, this industry is actively investigating the cleansing and related applications of chemicals and allied materials for scouring, degumming, boiling off, bleaching and dyeing.

The well known chemicals iron chloride and sodium chlorate are assuming new industrial importance in sewage filtration and clarification. Compressed air and chemical cleaners in use are now a common sight in cleaning building exteriors. The metal cleaning and electro-plating industries are very important users of chemical cleansers, including mineral acids, petroleum solvents and chlorinated hydrocarbon solvents, emulsifiers or wetting agents such as sodium metasilicate and trisodium phosphate, foaming agents, scum promoters such as ricinoleic acid, casein, etc., and acid-alkali balancers including caustic soda, soda ash, silicate and phosphate of soda, borax, etc.

CONSUMER DEMAND FOR CLEANSER

American soap production in 1929 was valued at $275,000,000. Laundry soap totaled about $82,000,000 in 1929 while sales of soap to power laundries, hotels, textile mills, etc., and interplant transfers totaled $23,684,000. According to those in the trade, steam laundries are the leaders in the use of soaps containing water-softening builders. Moreover the soap industry recognizing the importance of effectiveness for its products has enjoyed a gratifying increase in sales of the group of quick dissolving granulated and powdered soaps as reflected in the increase from 107,000 tons in 1927 to 168,000 tons in 1929. The latter was valued at nearly $36,000,000 while another $23,000,000 worth of cleansing, scouring and soap powders sold in 1929 includes products containing appropriate chemical softeners.

Another group of products used largely by households is "Cleaning Preparations," produced by some 429 establishments in 1929 to the extent of over $43,000,000.

FUTURE DOMESTIC AND FOREIGN TRADE PROMISING

This article, due to absence of data showing consumption of the various products as cleansing agents is neces-

(Continued on Page 643)

[1] Available from Government Printing Office, 10 cents.
[2] Boiler Water Treatment Technical Paper 218, Government Printing Office, 5 cents.

The Weighting of Silk

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CHAPTER IV—DURABILITY OF WEIGHTED AND UNWEIGHTED SILKS

This is the fourth and last in a series of articles on the weighting of silk. The relative durability of weighted and unweighted silk are compared herein. Previous articles in this series appeared in the AMERICAN DYESTUFF REPORTER in the following issues: Aug. 17, 1931, Chapter I, Historical; Aug. 31, 1931, Chapter II, The Development of Present Day Weighting Procedure; Sept. 14, 1931, Chapter III, Chemical Analysis and Control.

AFTERTREATMENTS FOR WEIGHTED SILKS

IN THE early days of silk weighting a great deal of the serious opposition to this process was based upon the supposition that contamination of the pure silk fiber with any form of metallic salts in any amount whatsoever, was detrimental to the strength and wearing qualities of the silk. This fact was discussed in some detail in the first chapter of this article. As a result of this situation the earlier inventors in this field busied themselves not only with methods for the weighting of silk but also with methods for retaining and preserving the strength of weighted silk in general, and tin weighted silk in particular.

At the end of this chapter there is given a bibliography of the patents dealing with this subject but a brief resumé of the proposed methods might be of interest at this point. Although the use of tin salts for the weighting of silk was described as early as 1883, it was not until 1906 that the first patent dealing with the aftertreatment of weighted silk was granted. This patent described the immersion of tin weighted silk in a solution of sodium or potassium sulfocyanate which was made slightly acid with sulfuric acid. A few years later there appeared another closely allied patent which specified an aftertreatment in a bath of thiourea slightly acidified with citric acid. A survey of subsequent patents shows that all compounds recommended for the aftertreatment of weighted silk contain nitrogen or sulfur in some form of combination.

Amines or amino-acids have figured quite prominently in the patent literature as agents for preventing the deterioration of tin weighted silks. For example, one patent advocates aftertreatment in a one-half per cent solution of compounds of hydroxylamine type or of its chloride, sulfate or nitrate; another patent recommends a one per cent solution of hydrazine acetate; and still another specifies hexamethylene tetramine. Such amino-acids as histidine and tyrosine are mentioned in several different patents.

Alkaloids have also received attention as potential preservatives for tin weighted silk. One of the earlier patents proposes to immerse the weighted silk first in a two per cent solution of sodium hippurate and then in a weak solution of hydrochloric acid. Some of the other alkaloids mentioned in this connection are caffeine, theobromine, cinchonine, tropine, cholin betaine, pyridine, pyrrolidine and quinoline. It is stated that the alkaloid solution must be free from metallic salts in order to be effective.

Among the sulfur compounds which have been recommended for the aftertreatment of weighted silk are sodium bisulfie and sodium thiosulfate either alone or in combination with aldehydes of monohydric alcohol such as formadlehyde. One patent specifies immersion of the weighted silk in a solution containing from one to five per cent of a formaldehyde-sodium bisulfite compound. Other patents mention different variations of this same group of compounds.

THE USE OF THIOUREA

Of all the compounds mentioned above, thiourea is the only one which has been used to any great extent on a commercial scale. The application of thiourea to weighted silk has not been practiced very commonly in the United states but according to a study of the records its use has been quite general among the silk dyers in Europe. Therefore it is of interest at this point to give a brief description of the method of application and to mention the benefits which are claimed to be derived from its use.

The thiourea treatment is a very simple one and may be carried out in ordinary wooden vats although stoneware basins are preferred. Copper vessels should not be used. An aqueous solution of from two to three per cent in strength is commonly used. The silk is immersed in the cold solution for a few minutes until it is thoroughly saturated and the excess solution is then removed by squeezing or whizzing. No washing is required and the silk is simply dried in the ordinary way.

It is claimed that the aftertreatment with thiourea increases the initial tensile strength and elasticity of weighted silk and materially decreases the tendering which would normally take place through long periods of storage. An exhaustive series of comparative tests were made by Sisley (La Revue Generale des Materiels Colorantes No. 146, February, 1909), on the effect of light, of heat and of storage over periods of two and three years. In all cases a piece of weighted silk was cut in half and one-half was aftertreated with thiourea. The portions which were aftertreated maintained a distinct superiority over the untreated

portions through all of the above mentioned tests. It was also noted that the thiourea treatment prevented the formation of mildew spots under conditions which would normally lead to their development on untreated silk.

The Effect of Weighting on Silk

In all discussions of the amounts of weighting given to silk there is apt to arise some confusion because of the different methods by which these amounts are expressed. For the sake of clarity, in this article all weighting is expressed as a certain percentage above par, i.e., above the weight of the raw silk. Thus if a 100 pound lot of raw silk was boiled-off in the usual way and then treated with weighting materials until it acquired a finished weight of 150 pounds, the amount of weighting would be expressed as 50%.

The extensive researches on the use of thiourea which were mentioned above, also furnished a good demonstration of the effect of various amounts of weighting on the durability of silk. For example, unweighted silk lost about 18% of its tensile strength after being kept one year in a sealed flask at a temperature of 30° C. whereas the same silk with 83% weighting lost approximately 56% of its tensile strength under the same conditions. Also a sample of unweighted silk showed a loss in tensile strength of only 3% after storage for 3 years at ordinary temperature. After storage for the same length of time under the same conditions, silk weighted 25% lost about 25% of its tensile strength; silk weighted 45% lost about 30% of its tensile strength; and silk weighted 83% lost about 43% of its tensile strength.

More recent experiments have shown less divergency in the behavior of lightly weighted silk as compared with the unweighted product. In 1926, P. Heermann (Seide, 34, 23—7), reported the results of a test in which he had stored variously weighted and dyed silks for a period of 3 years at ordinary temperature with the exclusion of light and dust. He found that lightly weighted fabrics lost but very little tensile strength during this period of storage whereas heavily weighted fabrics and particularly those which were dyed black showed an appreciable loss in tensile strength over the same period. All samples showed an appreciable loss in elasticity.

Modern experience has shown that silks for dress wear may be weighted from 35 to 40 per cent without any marked deterioration in their wearing qualities. In fact silks which have been given as much as double this amount of weighting are now accepted by the trade as satisfactory for many purposes. As a result of this experience an agreement has been reached among a number of the responsible silk dyers and finishers that the normal standards for amount of weighting shall be 35 to 40% for the higher qualities of silk, 55 to 60% for the medium qualities and 70 to 75% for the lower qualities.

In spite of the many discussions with regard to the deteriorating effect of weighting on silk and the maximum amount of weighting which could safely be applied, very little attention has been paid to the effect of improper handling during the weighting process on the subsequent durability of the silk. However, persons who are most familiar with the silk weighting game know that the handling of the goods during the various weighting operations has a great deal to do with their subsequent tensile strength. It is of interest to emphasize this point by mentioning a few of the factors which have a direct influence on the tensile strength of the finished silks.

Squeezing tthrough heavy rolls should be avoided through all stages of the weighting process and particular care should be taken not to press any creases into the goods. The excess of sodium silicate solution should be thoroughly washed out in order to avoid the possibility of precipitating free silica and drying it in the silk. Careful attention should be paid to the temperature of all the baths and particularly of the tin bath. The amount and type of finishing oils should be carefully studied. It is quite possible to improve the tenstile strength of weighted silks by a judicious selection of finishing oils and the correct application of the same.

A great deal has been done in recent years to remove the earlier antipathy toward weighted silk. The researches of the scientists have shown that a moderate amount of weighting has very little effect upon the wearing qualities of silk. The experiments of costume designers have shown that in many cases weighted silks have better draping qualities than unweighted silks. And finally the experiences of the public in general have shown that moderately weighted silks give satisfactory service in everyday wear. The only danger lies in the application of excessive amounts of weighting by certain ill-advised dyers. If this practice should become too prevalent it would be the surest way to kill the goose that lays the golden eggs.

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Enzymes and Their Applications in the Textile Industries*

By S. R. TROTMAN, M.A., F.I.C.

MANY processes in the textile industries are dependent upon specific enzymes and the deterioration of textile fabrics is due sometimes to their action. A knowledge of the nature and properties of enzymes is necessary for those engaged in textile industries in order that enzymatic actions may be kept under control.

Enzymes or "ferments" are organic bodies which act in a manner similar to inorganic catlytic agents; that is, they induce chemical changes without being themselves changed. Inorganic catalytic agents are employed in textile operations. or example, ammonium vanadate, copper sulphate and ferrous sulphate are used as oxygen carriers in the dyeing of aniline black. An extremely small quantity of ammonium vanadate is able to promote the oxidation of a large quantity of aniline.

Comparison with Inorganic Catalysts

In the case of inorganic catalysts it is not quite correct to say that they do not undergo any change. In reality they pass through a cycle of changes the last of which reproduces the original substance. Thus, cupric oxide is first reduced to cuprous oxide with the liberation of an atom of nascent oxygen, the cuprous oxide is oxidized again by the oxygen of the air, cupric oxide being formed again. Some catalysts are, however, in a different manner, namely, by the phenomenon of adsorption. When sulphur dioxide and oxygen are passed over heated platinized asbestos, both are adsorbed. The molecules of oxygen become changed into atomic oxygen, which combines with the sulphur dioxide to form sulphur trioxide.

Occurrence of Enzymes

Enzymes are present in many animal and vegetable tissues and are produced also by bacteria and moulds. They are colorless, amorphous, amphoteric, nitrogenous colloids which give the general reactions for proteins. Their constitution is unknown, but, like all colloids, they must have a very large molecular weight. They are soluble in water and dilute glycerol, but insoluble in organic solvents and are precipitated from their solutions by the addition of alcohol or ammonium sulphate. They are also adsorbed and carried down by such bodies as calcium phosphate or aluminum hydroxide when precipitated in their presence.

The chemical action of enzymes resembles that of ordinary catalysts in many ways, depending largely upon the development of a very large surface and adsorption. But their action differs in an important respect. A given quantity of an enzyme can only induce a definite amount of chemical change, whereas in the case of an inorganic catalyst there is no such limit.

Conditions for Enzyme Action

Enzymes act only under certain conditions which vary with their nature. The chief factors governing their action are temperature, hydrogen-ion concentration and the presence of electrolytes. Practically all enzymes become inactive at the freezing point. Their activity increases gradually as the temperature is raised until a maximum temperature is raised above this maximum, activity decreases, and at a second "critical" temperature it ceases. Heating above this point causes destruction of the enzyme, all being destroyed at 100 deg. C. The maximum temperature for animal enzymes is usually that of the body, i.e., 37 deg. C. Vegetable enzymes are commonly most active at about 25 deg. C., but there are exceptions, such as diastase.

Effect of pH

Hydrogen-ion concentration effects the action of enzymes in a similar manner to temperature. Every enzyme acts only between certain limits of hydrogen-ion concentration, which are not the same for all. Thus, diastase is destroyed directly the pH exceeds 7, whilst Rapidase can act at pH 8 to 9. The activity of an enzyme solution is diminished by dialysis, but again increased by addition of certain electrolytes or the dialysate; it is not affected by the presence of many antiseptics, such as thymol or chloroform.

The chemical changes brought about by enzymes are of three kinds, namely:—

(1) Simple hydrolysis.
(2) Oxidations and reductions.
(3) The induction of clotting, in certain cases.

The hydrolytic enzymes include:—

(*a*) Amylolytic enzymes, such as diastase.
(*b*) Cellulose resolving enzymes; cellulase, pectase.
(*c*) Lypolytic enzymes, such as lipase.
(*d*) Proteolytic enzymes; pepsin trypsin.
(*e*) Simple hydrolytic enzymes, such as amygdalase.

* Dyer and Calico Printer.

The oxidizing and reducing enzymes are associated generally, with bacteria. The others occur in various living tissues or are secreted by bacteria. Diastase, for example, is present in barley and malt, but is secreted also by all bacteria or moulds which are capable of bringing about the decomposition of starch.

Enzymes can be obtained from tissues containing them by extracting with water or a dilute solution of glycerol, concentrating the extract at a low temperature and adding excess of alcohol. The precipitate is re-dissolved in water and again precipitated with alcohol. The precipitated crude enzyme is now dissolved in water, subjected to dialysis and finally thrown down by alcohol, filtered off and dried at a low temperature.

Wood (*J.S.C.I.*, 1918, T313) prepared enzymes by taking advantage of the fact that cellulose adsorbs both proteins and enzymes from their solutions. Filter paper is soaked in the solution and dried. The dried paper is extracted with water. The enzyme dissolves while the protein remains on the paper. The solution thus obtained is purified by dialysis and precipitation with alcohol.

Detecting Enzymes

Enzymes can only be detected by establishing their power of inducing chemical action. Thus, if a substance is found to be capable of changing a sterilized solution of starch into maltose and dextrin, it must contain diastase, whilst if it liberates fatty acids from a neutral fat, a lypolytic enzyme must be present. When more than one enzyme is present the method of Achalme and Bresson (*Analyst*, 1911, 110) may be employed, which depends upon the fact that when a limited quantity of a single enzyme acts simultaneously on two different substrata, its action is divided between both, but when two enzymes are present each acts on its own specific substratum independently of the other.

One or two Enzymes

A small quantity of the enzyme preparation is allowed to act upon solutions of each substratum separately and, also upon a mixture of the two, under identical conditions of temperature and hydrogen-ion concentration. If the action on the mixed substrata represents approximately the sum of action on each separately, it may be inferred that two enzymes are present, but if the action on the mixed substrata does not exceed the sum of that on the separate substrata, only one enzyme is concerned.

The quantitative measurement of enzyme activity depends upon the determination of one of the products of the reaction which takes place when the enzyme acts on a substratum under strictly specified conditions. Thus, the diastatic activity of malt is proportional to the amount of maltose produced when 3 cubic centimetres of a cold filtered 5 per cent. solution are allowed to act upon 200 c.c. of a 1 per cent. solution of soluble starch at a temperature of 70 deg. F.

The proteolytic enzymes are examined in a similar manner by means of their action upon casein. Pure casein dissolves in alkalis, but is precipitated when the alkaline solution is acidified. When proteins are hydrolysed by a proteolytic enzyme they are changed progressively into proteoses, peptones, polypeptides and amino acids, each of which is less colloidal than the preceding product. Solutions of completely hydrolysed proteins give no precipitate, either when boiled or acidified. The standard method of Field-Gross is based upon these facts. A substrate is prepared by dissolving 0.1 grm. of pure caseinogen in 5 c.c. of N/10 sodium hydroxide and 25 c.c. of water. The solution is heated to 100 deg. C., cooled, about 4.5 c.c. of N/10 hydrochloric acid added to neutralize the excess of alkali and the volume made up to 100 c.c. with distilled water. An acid solution is prepared, also, by mixing 1 part of glacial acetic acid, 49 parts of water and 50 parts of 98 per cent alcohol. Two cubic centimetres of the casein solution are pipetted into each of ten test tubes, and from 0.01 c.c. of the enzyme solution up to 1 c.c. is added in gradually increasing quantities. The contents of each tube are made up to the same volume with distilled water, and the tubes are incubated for an hour at 37 deg. C. in a thermostat. They are then removed and six drops of the acid alcohol solution are added to each.

Where Enzyme Action is a Factor

A precipitate of casein will be produced in the tubes in which digestion is incomplete, and the first tube in the series in which no precipitate is formed indicates the volume of the enzyme solution necessary for complete proteolysis. The result is expressed as the number of cubic centimetres of the caseinogen solution which can be digested by 1 c.c. of the enzyme solution.

Enzyme action is a factor in many common textile processes, such as the desizing of cotton goods, the preparation of fermentation indigo vats, and the production of rancidity in oils. The destruction of textile fibres by the action of bacteria or moulds is dependent primarily upon enzymes secreted by the organism for the purpose of making the fibre available as food. Some of the more important of these actions may be described briefly.

Amylolytic Enzymes

Amylolytic enzymes are all characterized by their possession of the power of changing starch into a simple sugar, such as dextrose or dextrin. Diastase is the principal member of this group. Preparations containing this enzyme are used in desizing cotton and artificial silk goods, and in the preparation of starch finishing mixtures. Although diastase is distributed widely in both animal and vegetable tissues, the only varieties which are used to any great extent for the purposes named are malt diastase and diastase obtained from the bacillus subtilis, or similar bacteria. The former is sold as "Diastafor," the latter under the name of "Rapidase."

Animal diastases are secreted by the salivary and pancreatic glands and are much more powerful in their action on action than vegetable diastases.

When malt diastase acts upon gelatinised starch, soluble starch is first produced which is hydrolysed, gradu-

ally, into a mixture of maltose and dextrin. The temperature of greatest activity is about 65 deg. C.; from 65 deg. to 80 deg. C. the action is restricted and at 80 deg. C. the enzyme is destroyed. Hydrolysis of starch takes place only in neutral or faintly acid mixtures, the action being stopped immediately by the addition of alkali. The proportions of maltose and dextrin produced depend upon the temperature of the digestion. At 60 deg. C. three times as much maltose is formed as dextrin, at 66 deg. C. the proportion of dextrin is greatly increased and at 70 deg. C. it becomes the principal product.

Malt Diastase

Malt diastase is used chiefly in the form of an extract such as "Diastafor." It may be employed for the removal of starch from cotton goods before the lye-boil, the clearing of printed goods and the preparation of finishing mixtures of sizes. The preliminary treatment of sized goods with Diastafor is very advantageous, since it makes thorough lye boiling more easy to accomplish. The goods are steeped in a 0.5 per cent. solution of Diastafor for about 45 minutes at a temperature of from 150 deg. F. to 160 deg. F., and then rinsed with water. If preferred, a padding or washing machine may be used, or the goods may be simply impregnated with the solution and piled. The treatment cannot be employed if the goods contain soap or any other alkaline substance unless this alkali be first neutralized by means of a very dilute solution of acetic acid and water, which has an alkaline reaction is unsuitable for use with diastase.

Animal Amyloses

Animal amyloses and those produced by micro-organisms give much less sugar than diastase, and have a higher temperature of action. Diastrol DS and DB contain animal amylases which have a very great hydrolysing power over starch and produce only small quantities of dextrose. One part of the enzyme is capable of decomposing 30,000 parts of starch, the action being assisted by the presence of a small proportion of sodium chloride.

"Rapidase," a preparation containing the amylolytic enzyme of B. subtilis, is remarkable in that it acts either in a neutral or faintly alkaline solution, and is suitable, therefore, for the removal of alkaline size. Further, it is active at temperatures up to 203 deg. F., and the change from starch into soluble starch is brought about very rapidly at 174 deg. F. to 185 deg. F., although conversion into dextrin is comparatively slow. Owing to this rapid conversion into soluble starch, a continuous process of desizing is possible. The cloth is wetted with water at a temperature of 176-185 deg. F., and run over four or five rollers in a bath containing the Rapidase at 185 deg. F., then rinsed in water at 203 deg. F. About 10 lb. of Rapidase per 100 gal. of water are required, added to the bath gradually as the cloth runs through it.

Finishing Mixtures

Amylolytic enzymes are used in the preparation of finishing mixtures from starch, since by this means soluble starch and dextrin can be produced without the aid of chemicals. The starch is heated with water till incipient gelatinization sets in. Diastafor, or a similar preparation, is then stirred in and digestion continued at a temperature of from 150 deg. to 160 deg. F., till sufficient modification has taken place. The action of the enzyme is then destroyed by raising the temperature of the mixture rapidly to the boiling point or by adding enough alkali to produce a faintly alkaline reaction.

Starch and Dextrin

The proportions of soluble starch and dextrin produced depend upon the quantity of enzyme used and the temperature of digestion. In general, a high initial temperature and a comparatively large amount of diastase gives much dextrin, whilst less diastase and a lower temperature of digestion favors the production of soluble starch. Two examples may be given. To prepare a thick dressing, 2 lb. of Diastafor are dissolved in 25 gal. of water at 140 deg. F. and 60 lb. of starch are stirred in. The temperature is then raised to 160 deg. F., and the mixture stirred until the starch has dissolved with the formation of a milky fluid. The mixture is boiled, allowed to cool, and when cold 55 lb. of starch are added. The temperature is then raised to 212 deg. F., and the mixture stirred until a pasty homogeneous mass has been produced. This is cooled to 160 deg. F., 2 lb. of Diastafor added, and digestion continued at this temperature till the starch has just dissolved, when the mixture is again boiled. If a dressing containing a large proportion of dextrin is required, 100 lb. of starch are made into a paste with 12 gal. of cold water, and 1.75 lb. of Diastafor dissolved in half a gallon of water at 100 deg. F. are added. The mixture is digested at 160 deg. F., being stirred continuously until a thin solution is produced. The temperature is then raised to 212 deg. F., and the solution diluted to 20 gal. with hot water.

There is one disadvantage inseparable from the use of diastase in the preparation of finishing mixtures. Neither soluble starch nor dextrin can be obtained without the simultaneous production of maltose, and the longer the digestion the greater is the amount formed. Animal from this objection, the enzyme of B. subtilis being said to produce dextrin practically free from sugar. Rapidase is very suitable for the preparation of dressing mixtures. Thus, if a 15 per cent. starch paste be digested with 2 per cent. of Rapidase at 176 deg. F. for 30 minutes, a soft finish containing soluble starch and dextrin is obtained; after two hours' digestion only dextrin is present, and with times of digestion between 30 minutes and two hours products of intermediate composition are obtained. The author has used it successfully for the preparation of solutions containing as much as 50 per cent. of dextrin. After digestion is complete, the enzyme is destroyed by heating the mixture to the boiling point for a few minutes. The products of the reaction can be controlled also by varying the temperature of digestion. At 203 deg. F. stiff finishes containing little dextrin are produced and at 167 deg. F. to 176 deg. F.

dextrin as noted above. At temperatures between 203 deg. F. and 167 deg. F. gradually increasing proportions of dextrin are formed.

Obtaining Solid Dextrin

Solid dextrin may be prepared from starch by the aid of the amylolytic enzymes produced by B. macerans, B. subtilis or B. amylobacter. The last two are able to withstand a temperature of 100 deg. C. for a few minutes without being destroyed, and hence pure cultures are readily prepared. A sterilized 5 per cent. solution of starch is infected with the culture of the bacillus and incubated at about 45 deg. C. until no blue color is obtained with iodine. The solution is then boiled for some time to kill the bacteria, filtered and concentrated till it sets on cooling. The paste or jelly is dried at a low temperature and pulverized. Villier states (*De Keghel, Fabrication des Colles,* 621) that another carbohydrate is simultaneously formed which he terms cellulosine. It crystallizes with water giving crystals of the composition $C_6H_{10}O_5$ (H_2O) 1½. When crystallized from alcohol it yields a body having the formula $(C_6H_{10}O_5)_6$ $C_2H_6O.5H_2O$. Cellulosine is unfermentable and is changed into dextrose by prolonged acid hydrolysis.

Preparations containing proteolytic enzymes have important industrial applications, including the following:—

Levine (*J.S.C.I.,* 1916, 687) found that several different species of bacteria, such as B. subtilis, B. amylolyticus and B. fimi, secrete enzymes which are able to hydrolyse the proteins of cotton into soluble peptones or amino acids. He suggested the preliminary incubation of cotton with a culture of one of these organisms for about 48 hours with the object of removing the nitrogenous impurities before lye boiling.

Röhm (E. P. 100,224, 1916) used pancreatin for the same purpose, steeping the cotton for some hours in a 0.1 per cent. alkaline solution of this enzyme at a temperature of from 20 deg. C to 40 deg. C. He claimed, also, the use of other proteolytic preparations, such as the fresh pancreas of animals and papau fruit. He stated that lye boiling could be omitted, mere washing with water being required, since the pancreas secretes a fat splitting enzyme which, in the presence of sodium carbonate, converts fat into soap. This process has however, not been used very much. The proteins of cotton are very easily removed in the lye boil; it is the waxes and pectins which are the chief cause of trouble. Neither of these would be affected by proteolytic or fat splitting enzymes and would still have to be removed by means of a lye boil. The proteolytic enzymes secreted by bacteria or moulds are responsible for the destruction of nitrogenous fibres such as silk and wool, and frequently for the decomposition of dressings containing gelatin, glue or other proteins.

When cotton is attacked by microorganisms, the first thing which happens is that an enzyme termed "cytase" or "cellulase" is secreted, which hydrolyses insoluble cellulose into dextrose thus,

$$C_6H_{10}O_5 + H_2O = C_6H_{12}O_6.$$

This dextrose together with traces of nitrogenous matter, which are present even in bleached cotton, serve as food material for the organism. Continuous growth is thus possible until the cotton has become destroyed.

Lypolytic enzymes, termed "lipases," have the power of hydrolysing oils and fats into free fatty acid and glycerol. Thus, in the case of tristearin, the reaction is represented by the equation,

$$(C_{17}H_{35}COO)_3C_3H_5 + {}_3H_2O. =$$
$${}_3C_{17}H_{35}COOH + C_3H_5(OH)_3$$

These lypolytic enzymes are secreted by bacteria and moulds, and occur naturally in seeds such as the castor oil seeds. Unrefined or incompletely refined oils generally contain lipases, which, under favorable conditions, bring about the hydrolysis of the oil. The presence of free fatty acids in a textile oil is a sign that the oil is likely to become rancid, especially if it contains unsaturated triglycerides. The use of pancreatic fat splitting enzymes in the purification of cotton has been mentioned above.

Oxidizing and reducing enzymes are termed "oxidase" and "reductase" respectively, and promote either oxidation or reduction. Malt extract contains an oxidase. When it is added to a solution of bleaching powder or hydrogen peroxide, the oxidizing action of the solution is accelerated greatly. Lehmann (Ger. Pat. 279,993) claimed that when bleaching delicate cotton goods or artificial silks, the addition of malt extract to the bleaching liquor enables the time required for bleaching to be shortened greatly and saves 50 per cent. of bleaching powder. Reducing enzymes, secreted by bacteria, are responsible for the changing of indigo into indigo white in the preparation of the "fermentation" vat. This method has been superseded by the use of sodium hydrosulphite, the action of which is easier to control. The action of reductases may be demonstrated readily by adding a trace of methylene blue to an old sample of milk, and incubating the mixture for a short time at 37 deg. C. Among the bacteria present in milk are many which secrete reductase, which incite the reduction of the methylene blue to the leuco-compound, thus causing the disappearance of the blue color. The test is actually used to distinguish between fresh and old samples of milk.

Announce New Sampling House

The United States Testing Co., Inc., have announced the opening, on Sept. 1, 1931, of their Greensboro Sampling House. This is in keeping with the company's policy of expansion to meet the changing needs of the textile industry. The Greensboro office will be in charge of Mr. S. J. Gillie.

AMERICAN DYESTUFF REPORTER

Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto.

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FIVE DAY WEEK

IN DECEMBER of this year, Senator Schall of Minnesota will introduce in Congress a bill proposing a five day week for government employees. The bill will not call for any reduction in the present rate of compensation. Senator Schall stated that the bill is to set an example to private industry in the curtailment of production. The details of his plan have not yet been made public.

A five day week in all industries would help to equalize production and consumption and at the same time give a greater number of people opportunity for employment. Cutting down the number of hours per week is essentially necessary. In former times when everyone secured the ultimate necessities of life by their own hand, they had to work hard enough and long enough to satisfactorily provide themselves. That was not an age of specialization, it was an age of generalization. At present, with our machinery and its high speed production, if every one works every day in the week, we eventually produce an oversupply of commodities which results in unemployment. When there is no longer a demand for a product there is no longer a demand for the labor involved in putting that product on the market. It is now no longer necessary for a person to spend as many hours at work as formerly in order to produce an equivalent amount. To be sure, population is increasing all the time and there is an increased consumption of all commodities, but the speed of output is increasing at a faster rate. The only way to prevent an oversupply is to cut down production and this is most easily and most reasonably accomplished by cutting down the hours of labor. This condition will eventually be coming. The five day week is the accepted condition in many industries now.

With the decrease in working hours there will be a corresponding increase in leisure time. Increasing the amount of leisure will eventually bring about a higher standard of living. There will be more time for self-improvement which will quicken the desire for the better things in life. Those who have been denied the higher types of enjoyment through lack of time (or lack of money during a season of unemployment) will be able to benefit through the five day week.

The spiritual effect of a shorter working week will be especially beneficial. Too many hours at one job makes the task drudgery and the worker become discontented. More time for pleasure improves the morale of the laborer and he takes a keener interest in his work and also in outside attractions.

In depressed periods of business activity the hours of work are always shorter through necessity, in fact, they are cut down to three or four weeks and in many cases there is an enforced cessation of all work. And yet in a boom period these same industries will be back to a 60 hour week. A five day week program needs the co-operation of all. If one branch of an industry fails to observe this shorter hour program other related industries will be forced to keep up with it. Let's follow the Senator's suggestion in our private industries.

BE PREPARED

FOR what, you may ask. The answer is: everything and everything that comes your way. We say that some people get ahead because they get the "breaks." But suppose they had not been ready to accept and cash in on these breaks, would they be where they are today? On the surface of things it might look as though that particular person were playing into the hands of luck. But who knows how many years he has been planning and preparing himself to grasp the opportunity when it came? Preparation means hard work, and plenty of it—more than mere strenuous mental labor—it means mental progress with definite foresight—looking ahead and the ability to foresee opportunities. Instead of waiting for opportunity to come along, work toward it and overtake it. There may be a vacancy somewhere that represents a worthwhile position. To the person who is prepared this means an opportunity, but to one who has not prepared himself for the vacancy it is not such, and he finds himself unqualified.

The greater our scope of knowledge, the more numerous are our opportunities. If we put forth a strong effort to prepare ourselves for advancement, rather than sit by and just wait, we will find more opportunities opening up.

Perhaps you are one of those persons who think that the day of opportunity has passed, that progress is now cut down to a minimum. If so, read the following extract from *Tee-Pee Flashes*:

"When we complain today about the lack of opportunities do we not overlook many mighty problems that clamor for solution? What of the industrial, commer-

cial, financial, and social problems that so sorely vex the nation?

"There is the railroad problem, the overproduction problem both of industry and agriculture, the distribution problem, the financial problem, the taxation problem, and numerous other problems both local, national, and international. What do we know about them? What are we prepared to offer in the way of their solution? The answers to these problems would be welcome from anyone."

And yet are you prepared to do anything about it? There is always something turning up that needs solution. If we are prepared we can meet the situation. If we are not, someone else probably will be, and what is a problem to some will represent an opportunity to others.

FEDERAL-OWNED UTILITIES

IN AN editorial of September 14th we spoke of the unfavorable results of the government interfering with or running private enterprises.

In a recent address before the American Bar Association, the same idea was expressed by Governor Albert C. Ritchie of Maryland who opposed government ownership and federal government control of public utilities.

One of the points brought up by the Governor, in speaking of the power industry, was the loss in taxes. He said in part:

"The taxes paid by the power industry would, of course, be lost in case of government ownership. In 1930 these taxes amounted to $200,000,000 of which over 32 per cent went to the Federal Government, from 10 to 15 per cent to the State governments, and the remainder to the various counties and cities. These taxes amount to practically 10 per cent of the gross revenues of the power companies. If the industry stops paying this enormous sum toward the support of government, as it would do if the government took it over, then the already overburdened taxpayers of the country would have to dig down and make it up. Thus a movement whose alleged purpose is to help the public would tax the public $200,000,000."

The tax situation is a new angle in considering government control of industry. If it results in a tax loss in the case of the power utilities, the same would be true in other forms of business.

Swiss Coal-Tar Dye Exports

According to Vice Consul Albert W. Scott, Basel, the decline in Switzerland's coal-tar dye exports, evident since the beginning of the year, is reflected in the 1931 six months export figures of 3,072,436 kilos, valued at 29,961,993 francs (1 franc = $0.1938; Six months 1931—$0.1931.) compared with shipments of 3,561,861 kilos, 35,068,783 francs during the corresponding period in 1930.

Production in Japan

According to Assistant Trade Commissioner H. B. Titus, Tokyo, during the first six months of 1931 the production of bleaching powder in Japan amounted to 18,929 metric tons, a decrease of 5,006 tons from the first six months of 1930. The production of caustic soda for the first six months of 1931 was 17,389 metric tons or an increase of 1,369 metric tons for the same period of the preceding year.

New Color

The Sandoz Chemical Company have just brought on the market, a new Violet of the Anthraquinone series, under the name—Alizarine Light Violet 2RC. This product is said to be faster to light than the old type of Alizarine Irisol. For the new Sandoz product is also claimed the advantage that it stands chrome and therefore should find a wide application for shading chrome colors.

Research on Paperboard Containers

Dr. Edward R. Weidlein, Director, Mellon Institute of Industrial Research, Pittsburgh, Pa., has announced that an Industrial Fellowship for research on moistureproofing and greaseproofing paperboards used in cartons and boxes has been established in that institution by the Robert Gair Company, of New York, N. Y. Recent progress in package merchandising has indicated, he pointed out, a growing need for paperboard containers with improved moistureproofing and greaseproofing qualities, and he said that it is the hope of the Robert Gair Company, the donor of the Fellowship, and of Mellon Institute that technically valuable advances will result from the studies which were begun on September 1.

Dr. Marion D. Coulter has been appointed a Fellow of the Institute, to conduct these scientific investigations. He is a specialist in organic chemistry and during the period 1925-1930 held a Mellon Institute fellowship for the study of certain problems in cellulose technology.

According to Dr. Weidlein, Dr. Coulter's new research on perfecting moistureproof and greaseproof paperboards for packages will be of interest to many industries. If successful, the investigational developments are expected to make possible important economies and improved efficiency in distribution, as well as to act as a further stimulus to the growth of package merchandising.

Celliton Red Brown 5R

The General Dyestuff Corporation releases Cellitone Red Brown 5R Powder, a homogeneous reddish brown acetate silk dyestuff for which is claimed good fastness to light, acid and perspiration and very good fastness to water and washing.

Participating Laboratory

The Textile School of North Carolina State College has accepted the invitation of the United States Institute for Textile Research, Inc. to become a participating or cooperating laboratory of the United States Institute.

The New Supreme Court of Color-Marks

By **WALDON FAWCETT**

IF IT promised no more than a conclusive, permanent Federal administrative policy in respect to attempts to monopolize individual colors for purposes of merchandising branding, the new "supreme court" at Washington would be welcome. In reality, the special tribunal goes far beyond that in its mission for the stabilization of trade mark practice. Not merely the use of color for trade marking, but likewise all the perplexities that attend the acceptance of mediums of identification for dyestuffs and colors, are within the jurisdiction of the new authority.

Some months have elapsed since Congress created the new U. S. Court of Customs and Patent Appeals, delegating to it the review or reconsideration of all rulings made by the administrators or tribunals of the U. S. Patent Office. It waited, however, upon a decision by the Supreme Court of the United States, in the early summer of 1931, to give the new institution its full force and effect as a court of last resort for all questions involving the registration of trade marks.

Prior to the establishment of the new Court of Patent Appeals, the rulings incident to the conduct of the Federal clearing house for trade marks were subject to review by the Court of Appeals of the District of Columbia. There was always a hint of lack of finality in the ultimatums of this court because it was possible for an unsatisfied trade mark claimant to obtain further recourse. On rather infrequent occasions, with constitutional questions involved, the U. S. Supreme Court was persuaded to say the last word in interpretation of the trade mark laws. Certain of these mandates by the U. S. Supreme bench, as, for example, the one covering the use of a colored strand or colored core as a mark for rope, have long been "controlling" in the registration of trade marks that employ color as the main medium of recognition.

By flat refusal of a plea for intervention, the U. S. Supreme Court, in effect, served notice that it will not vise the decisions of the new Court of Patent Appeals. In denial of the petition of an irreconcilable, the Supreme Court said tersely that it was without jurisdiction to review the decisions of the new court. The immediate consequence of this vindication of the infallability of the new court has been to bring before it a number of controversial cases in each of which the ultimate verdict is momentus not only in the destiny of an individual interest but in influence upon the future practice of an industry. Disclosure of the power of the new court is also causing business executives in all lines to scan its pronouncements for keys to amend principles of trade marking—a pursuit that is due for ample reward because, already, the new court has bade defiance to certain traditions cherished at the Patent Office.

Before going further into the workings of the new supreme court of color-marks it may be well to emphasize the scope of the new censorial institution. The Court of Patent Appeals may be said to be absolute in respect to all matters affecting the registration of trade marks, the cancellation of marks that may be held to have been entered unlawfully, and the classification of commodities which is the basis of trade mark allotment. In other words, every official action, incident to the certification of trade marks at the U. S. Patent Office, is subject to analysis and appraisal by the new board of five Federal judges. But the special court has no jurisdiction over issues of trade mark infringement or over the alleged abuses of trade marks which are asserted to accomplish unfair competition or unfair trading or "passing off" of goods. Quarrels of this nature, over rights in industrial property, may be expected in the future, as in the past, to end in the U. S. District Courts or in the U. S. Circuit Court of Appeals.

From the standpoint of chemists and marketers of dyestuffs, interest in trade mark policies and practices must ever be keenest at the registration stage. The majority of traders do not pursue to the last ditch the quest for authenticated title to a commercial nickname or emblem. In a majority of instances, the trade mark aspirant bows to the final pronouncement at Washington. And, just in proportion as greater store is set by the Governmental franchise is there less and less disposition in business circles to risk dependence for the long pull upon a mark that has been denied the birth-certificate which is, within its limits, an acknowledgement of priority. Upon this scene of growing recognition by trade markers of the inevitable comes the new court—an overlord manifestly intent, from the outset, upon the adjustment of trade mark policies to modern commercial conditions rather than slavish adherence to judicial precedents established in a less-crowded age.

Plausibly, the new court, as it gradually visualizes by concrete example the revised principles of trade marking,

will simplify, for the rank and file the entire routine of branding onward from the stage of first inspiration. As the new court assembles a gallery of tests cases it will be possible for the layman, by consulting the historic object lessons, to determine pretty accurately, in advance of expense and commitment, the chances of Federal acceptance of a proposed new mark. Theoretically, this method of deduction should have been available in the past. But the varying administrative policies of successive Patent Commissioners, and the incomplete nature of the judicial review, left many everyday trade-markers hopelessly in doubt as to the vulnerability of specific marks or types of marks.

That the special court is not disposed to shirk the responsibility that will henceforth rest upon it is eloquently attested by the more liberal construction which it has, from the outset, placed upon the liability known as "confusion in trade." To prevent or cure trade confusion is, in the practical sense, the main objective in our present system of Federal control of trade marks. Until the new court took its advanced position, though, there was a disposition, when apportioning trade mark franchises, to regard "confusion of trade" as synonymous with "confusion of goods." That is to say, the impulse was to hold the presence or danger of confusion to be contingent upon the probability of acceptance by the average ultimate consumer of one article by mistake for another article under the same or similar trade mark. Reversing the rulings of the Commission of Patents in a number of "confusion" cases, the new court has served notice that henceforth the hazard of trade confusion must be accounted to embody not only the risks of confusion or substitution of goods, but likewise confusion of reputation, so called. In avoidance of the latter, the court has shown its willingness to reject any trade mark which, when displayed upon goods (even though of unrelated or distantly related character) would cause the unsophisticated purchaser to assume that the wares were of the same origin or ownership as other goods, association with which had rendered the mark familiar.

Liberal though it be in some of its leanings, the new court has shown no disposition to modify the principle that no trade mark monopoly is attainable in "mere color." But, for all the unwillingness to accept color, as such, as a registrable trade mark for the article of manufacture in which it is embodied or to the surface of which it is applied, there is leniency for particular expressions in color. Designs or emblems or arbitrary devices do not suffer because rendered in solid color, even though it may be guessed that ultimately the public will become color-conscious rather than design-conscious. The recent experience of the Dayton Rubber Manufacturing Company goes to show that in the present stage of trade mark censorship, the most dangerous twilight zone is occupied by the color expressions which may be construed as being ornaments, decorative of the goods, rather than arbitrary additions to design, intended to serve solely the purpose of technical trade marks.

New Patents

2.3 *Hydroxynaphthyl-Arylketones.* (Intermediates for the production of dyestuffs, for example, ortho hydroxydiarylketones, obtained by treating ortho hydroxylaryl carboxylic acid halides with aromatic hydrocarbons or substitution products thereof in presence of acid condensing agents, preferably of aluminum chloride.) Arthur Zitscher, of Offenbach-on-the-Main, Ger., assignor to General Aniline Wks., Inc., of N. Y., N. Y., No. 1,817,957, August 11, 1931.

Process for the Production of Vat Dyestuffs. (Obtainable by heating 2-iodo-coeramidonine with copper; dye cotton bright reddish-brown shades). Arthur Luttringhaus, of Mannheim, and Paul Nawiasky and Artur Kraus, of Ludwigshafen-on-the-Rhine, Ger., assignor to General Aniline Wks., Inc., of N. Y., N. Y., No. 1,817,995, August 11, 1931.

Vat Dyestuffs. (New articles of manufacture, halogenation products of 8.8'-dihydroxy-1.2.1'.2'-dinaphthazines, readily soluble in organic solvents and convertible into red vat dyestuffs by splitting off halogen.) Walter Bruck and Fritz Helwert, of Mannheim, Ger., assignors to General Aniline Wks., Inc., of N. Y., N. Y., No. 1,818,037, August 11, 1931.

New Azodyestuffs. (Obtained by coupling meta aminophenylmethylpyrazolone with a reduced condensation product of 2-naphthylamino-4:8-disulfonic acid, para-xylidine, and paranitrobenzoyl chloride; dye cotton clear yellow shade and capable of being diazotized and developed with coupling components.) Karl Dobmaier, of Wiesdorf, Ger., assignor to General Aniline Wks., Inc., of N. Y., N. Y., No. 1,818,049, August 11, 1931.

Condensation Products and Vat Dyestuffs of the Benzanthrone Series. (For example, the caustic potash condensation of acetonyl-Bzl-benzanthronyl sulphide obtained by the action of monochloracetone on sodium Bzl-benzanthronyl mercaptide and its conversion into a vat dyestuff by hydrolization and oxidation.) Arthur Luettringhaus, of Mannheim, Heinrich Neresheimer, of Ludwigshafen-on-the-Rhine, and Willy Eichholz, of Mannheim, Ger., assignors to General Aniline Wks., Inc., of N. Y., N. Y., No. 1,818,075, August 11, 1931.

Manufacture of Dyestuffs and Intermediates. (Consists in the condensation of dichlor-dibenzanthrone with ethylene glycol in the presence of potassium carbonate and copper. Dyestuffs dye cotton slightly reddish blue shades.) Robert Fraser Thomson and John Thomas, of Grangemouth, Scotland, assignors to Scottish Dyes, Ltd., of Grangemouth, Scotland, No. 1,818,510, August 11, 1931.

Process of Manufacturing Color Lakes from Petroleum. (By treatment, with water-soluble dyestuffs and water-soluble metal salts. A division of original application filed August 24, 1926, Serial No. 131,311.) Gellert Alleman, of Swarthmore, Pa., assignor to Sun Oil Co., of Phila., Pa., No. 1,818,778, August 11, 1931.

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The Development of Mildew on Wool*

By R. BURGESS, M.Sc., F.L.S.

THE development of micro-organisms on wool, technically known as "mildew" may occur at any stage of manufacture from raw wool to finished cloth. The scientific study of mildew is still in its infancy, and present knowledge allows only of broad generalizations concerning it. Investigation can be made along two lines—the micro-organisms responsible for mildew may be investigated with particular regard to their classifications, physiological activities, and wool-decomposing properties; or the inquiry may be conducted on more practical lines by investigating the incidence of mildew on processed and partially processed wool, with special reference to the variations in susceptibility which these materials exhibit.

The former method of approach may be considered the more scientific, since it would yield information fundamental to the study of the problems involved. On the other hand, the application of such knowledge would still necessitate an investigation of the physical and chemical conditions peculiar to the wool at any particular stage of manufacture.

Attention has been particularly focussed, therefore, on the second line of inquiry and investigations have been carried out by the Wool Industries Research Association on the influence of certain environmental factors on mildew development.

Influence of Moisture

Moisture is undoubtedly the chief factor which controls the appearance of mildew on wool, but the interrelationships of micro-organisms, moisture and wool still require much further elucidation. The minimum amount of moisture necessary for mildew development varies with the kind and condition of the wool concerned, and particularly with its degree of cleanliness.

At 23° C., a commercially scoured worsted cloth, containing about 0-5% alkali reckoned as sodium carbonate, will not mildew unless its moisture regain is approximately 24%, which corresponds to the quantity absorbed from an atmosphere of 94% R.H. Unscoured yarn, raw wool in the grease, or sized goods mildew at a lower R.H., whereas growth appears only slowly on well washed wool, even in a moisture-saturated atmosphere.

As a rule, cotton and other vegetable fibers develop a heavy growth of mildew at a considerably less moisture content and lower humidity than does wool. Contact of wool with these materials is, therefore, undesirable, as it enhances the liability to mildew.

Growth which develops on wool at low humidities is composed almost invariably of mould fungi; bacteria requiring relatively larger quantities of moisture, and being seldom found in quantity even on goods stored in a saturated atmosphere in the laboratory. Consequently, their wool-decomposing activities are confined to wool which is actually wet. Mould fungi are almost always responsible for the mildew which develops on goods, e.g., tops and yarn, stored originally with a standard regain, whilst both groups are concerned with the damage to wool left for several days in a wet or very damp condition.

Nutritive Properties of Wool

The next essential for mildew development is the nature and quantity of available food material in the wool. The principal constituent of wool, i.e., keratin, is very resistant to the hydrolytic action of microbial ferments and thus thoroughly washed and chemically clean wool mildews much less readily than wool containing dirt, grease and other foreign matter.

Investigations have corroborated the generally accepted idea that the presence of a small amount of alkali in wool promotes the development of mildew. Such a condition of increased susceptibility is produced by detergent substances, e.g., soaps and wetting-out agents, and is probably due chiefly to increase in available nutriment resulting from some hydrolysis of the wool. The higher fatty acids present in soaps also enhance mildew. A further possible contributory factor in the case of hygroscopic soaps, e.g., potash-olive-oil soap, is the increase in range of R.H. over which mould growth can take place.

Vegetable oils, e.g., olive oil, also promote the growth of mould fungi on wool, although the increase is not so marked as with soaps. In such case the formation of mildew is accompanied by a disappearance of oil, which undoubtedly acts as a source of carbohydrate nutriment. It is probable that the presence of alkali is essential for this process, since by hydrolyzing the wool it provides the essential food element nitrogen. A determination of the relative importance of the various factors involved is, however, a very complex problem; it would appear, e.g., that the degree of solubility of the wool is of greater moment than the actual quantity of alkali or oil in determining the liability to mildew.

Minerals oils do not stimulate mildew development, but tend, on the contrary, to check it.

*Journal Society Dyers and Colorists.

An interesting fact is the marked resistance to mildew resulting from the removal from the wool of water-soluble substances. These have been found to contain all the food elements essential to growth of mildew, and by a thorough rinsing the prime cause of mildew trouble is eliminated. It is to be regretted, therefore, that much washing is prejudicial to the handle of the wool.

The presence of strong acids also favor the growth of moulds; a fact which has been borne out by both laboratory experiments and many practical occurrences. Faults due to mildew arise more frequently, however, on alkaline goods, which is only to be expected, since a condition of slight alkalinity predominates during the early processes when the wool is chemically less clean. Furthermore, the activity of bacteria is checked by even a slight degree of acidity, so that the liability to faults due to mildew is considerably reduced after dyeing.

Resistant Properties Resulting from Chroming

Special attention has recently been given to the resistance to mildew resulting from the use of chrome in the dyebath. Of 131 laboratory dyed samples exposed, 46 out of the 49 which showed considerable resistance had been chromed. The same effect was observed in the presence of small amounts of acid and alkali and confirmed by the results of similar exposures of commercially dyed material. The most probable explanation of this phenomenon is that the chroming process causes a diminution in the amount of readily available food material in the wool. No evidence was obtained either that chroming lowered the hygroscopic properties of the wool, or that wool so treated exerted a pronounced toxic action towards microbial growth, but a distinct reduction was noted in the solubility of the chromed wool in hot water, as indicated by the total nitrogen content of aqueous extracts. In addition, it was observed that, in the few instances examined, the chroming process actually removed a considerable quantity of water-soluble protein material from the wool.

Condition of the Fiber in Relation to Microbiological Activity

The nutritive value of wool is influenced by the actual state of the fiber as regards its degree of soundness. It is well known that all wool fibers suffer a certain amount of damage, principally at the tip ends, as the result of weathering whilst still on the sheep's back. Subsequent processing of either chemical or mechanical nature augments the initial damage and also tends to lower the protective value of the epithelial scales generally. The most seriously injured fibers are the first to be attacked by micro-organisms, especially by bacteria, when the conditions are favorable, the infection subsequently passing to sound or only slightly damaged fibers.

By means of the Pauly test[1] for the degree of soundness or intactness of the scales, it is possible to follow the progress of fiber disintegration produced by bacterial action, and to measure its extent.

Effect of the Presence of Inhibitory Substances on Mildew

The practicability of treating textiles with antiseptics as a means of preventing the development of mildew during storage or transhipment abroad has received considerable attention. The Shirley Institute has made investigations to the effect of the addition of a very large number of antiseptics to size mixings. The substance proving most suitable for this purpose, viz., "Shirlan,"[2] is now being applied with success in the cotton industry.

In the case of wool, investigation has been focussed chiefly on the inhibition of the growth of mould fungi, since these organisms are the more frequent cause of mildew on wool. The technique adopted has been to immerse unscoured yarn or scoured cloth in solutions of antiseptics, and, after subsequent drying, to expose the material to conditions suitable to the growth of the organisms, the progress of mildew development being followed by microscopic examination at weekly intervals.

Only a few substances out of some 150 tried, possess the property of checking or retarding the growth of mould, and are at the same time suitable for commercial application. These are sodium fluoride, sodium silicofluoride, Shirlan N.T. and *B*-naphthol.[3] A detailed list of the results obtained is to be found in Publication No. 140 of the Wool Industries Research Association.

The treatment of goods which demand protection while they are in a wet or very damp state is also under consideration. Pending the discovery of a more suitable substance, the application of sodium silicofluoride mentioned by Hirst is considered satisfactory, especially since it is inimical both to mould fungi and bacteria. Bacteria may be kept in subjection by rendering the wool acid, but the growth of fungi may take place over a comparatively wide range of acidity and alkalinity, e.g., that of wool cloth wetted out in 1% solutions of sulphuric acid and sodium carbonate respectively.

Prevention of Mildew

As the presence of moisture is an absolute necessity for the growth of micro-organisms, the most effective way of avoiding mildew during storage is to ensure sufficient ventilation and to avoid the formation of areas of stagnant air. This procedure is specially necessary in view of the fact that goods are generally stored in buildings provided with ordinary concrete floors which, through their ability to transmit moisture from the earth, tend to increase the humidity of the atmosphere under the bale or skep.

Further precautions against mildew are to avoid the presence of soaps and conditioning agents, to prevent contact with the relatively more susceptible vegetable fibers, and to reduce to the minimum the period between different processes during which materials are wet or damp. Strongly alkaline conditions should be particularly avoided on both chemical and biological grounds. Except in the case of sized goods, the above precautions should be adequate to ensure protection for wool.

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Mildew Growth on Cellulose Acetate Fabrics*

By JOHN ECCLES

THE occurrence of mildew or mould fungi on fabrics made from cellulose acetate yarns has been for some time the cause of troublesome complaints. There is very little known about the action of moulds on cellulose acetate. The investigation of such a subject is naturally a lengthy one. Little can be done usefully with garments returned to the makers, because, as is usually the case, no precise history is provided. Mildew on cotton and wool has, during the last few years, received considerable attention, and the accounts of some researches have been published in the literature dealing with textiles.

Mould growths on fabrics containing cellulose acetate were originally observed on cloths dyed black or navy blue. In the course of the work which has been done on the subject, it has been shown that the growths may occur on fabrics of any color and on undyed fabric. At first the spots were observed only on fabrics composed partly of twisted yarns, the broken surface apparently affording partial protection against removal by rubbing. Certain parts of garments appear to be more susceptible than others. Seams, pleats, flounces, etc., would grow moulds, while the rest of the article would be free. Mould spots were found to be readily removable by light brushing, but, as would be expected, new growths very soon appeared.

Examination of the mould growths by means of the microscope was conducted at considerable length. No particular and characteristic mould was observed. Usually it was found that a number of different kinds of mould growth could be detected on garments returned on account of having become mildewed. Cultures made on jellies in Petri dishes confirmed this observation. Examples of the moulds found and cultivated are: Aspergillus; Rhizopus; Penicillium; Mucor; Fusarium; Alternaria. Most of the spots were indistinguishable from dust and dirt until after incubation. Some of the areas of the fabric showing a number of mould spots suggested the actual sprinkling of fine powder on the cloth. In general no hyphæ were observed until incubation had taken place.

Since the mould fungi are minute plants which do not contain chlorophyll, they can exist under conditions different from those required by green plants. Unlike the latter, mould fungi can absorb directly sugars, starches, and proteins, which are not assimilated as such by ordinarly plants. Some of the kinds of mildew—*e.g.*, Aspergillus, Mucor, and Penicillium—can produce enzymes which will cause starch to ferment, and Chætomium produces an enzyme which will break down cellulose in paper and cotton. As with other minute organisms, the ranges of temperature through which the mould fungi may exist are wide, the rate of growth naturally increasing with increasing temperature. Aspergillus and Penicillium include both acid and alkali producing species.

In the work that has been done so far on the growth of mould fungi on cellulose acetate no breakdown of the fiber, with consequent tendering and rotting, such as are well known to occur with cotton and with wool, has yet been observed. There appears to be no reason to assume that the action on cellulose acetate is different in principle from that on other materials. It is possible that further investigation may show that destructive action is possible.

When cotton fabrics were exposed to infection in an incubator along with cellulose acetate fabrics, the relative humidity of the atmosphere being probably 80% or above at 25° C., it was always observed that the development of mildew on the cotton was far more rapid than on the cellulose acetate. Many suggestions were soon forthcoming as to the cause of the mould growths on cellulose acetate. These have been the subject of extensive investigation, frequently with negative results. The suggestions which appeared most likely to be correct were first examined. Since a nitrogenous substance like gelatin always affords a very suitable medium for the growth and development of plant life of these low orders, this substance, being a common constituent of warp size, was first suspected. It was suggested that the gelatin was not completely scoured out before dyeing, and that dyeing probably rendered the residual gelatin either insoluble or nearly so. Many tests for gelatin on fabric were therefore made. The sensitivity of the chloramine test was investigated by experiments on solutions in distilled water of gelatin of known strength. The maximum possible

*Textile Manufacturer.

gelatin content of the fabric was known from the quantity and composition of the size applied. The test might have detected the small amounts of residual gelatin in the form of a simple solution in water. It was found that on application to water extracts of fabrics to which known amounts of gelatin had been added, the sensitiveness of the test fell enormously. This test was thus shown to be utterly inadequate to detect even qualitatively the small amounts of gelatin likely to remain after scouring. Similarly, the biuret test, though extremely sensitive for solutions of gelatin in distilled water, was inapplicable to water extracts even of white fabrics. For colored fabrics, particularly blacks and navy blues, there was obviously no hope. The Kjeldal test for nitrogen was suggested, and shown to be insufficiently sensitive.

In one quarter residual soap was also blamed. Though the suggestion was an unlikely one, tests were made. It was impossible to grow moulds on soap jellies, though they were very freely infected. A number of the dyestuffs in the form of pastes were found to grow moulds freely on infection. As the majority of these are nitrogenous substances, this result was not surprising. It was felt, however, that little could be argued as to the effect on mould growths on the dyestuff on the fabric from the result of a culture on a dyestuff paste in a Petri dish.

Many experiments have been carried out on the use of antiseptics to prevent the growth of mould fungi. In many ways, as would be expected, the results are parallel to those found in the published accounts of research work on mildew prevention in cotton. Most of the really effective antiseptics are, for some reason or other, inapplicable. Some new products which have not been long on the market were tried. The results were singularly disappointing, though every care was taken to apply the materials precisely as directed. The low sorptive power of cellulose acetate is probably antagonistic to the application of such substances.

Cellulose acetate has a low moisture content. It is roughly one-half of that of cotton and one-quarter of that of wool under ordinary conditions. In general, therefore, there will be very little encouragement for mould fungi to grow since moisture is favorable to their development. Such forms as do become established may be those which can thrive under drier conditions.

Dust, as is well known, is an excellent carrier of infection, and it is highly probable that this agent is particularly active in the case of the infection of cellulose acetate fabrics. Of the importance of dust there can be no better proof than the care necessary in the process of making cultures to avoid undesirable infections. Frequently the particles of dust either consist of nutrient material or carry nutrient material, for mould can be grown on the particles of dust which have settled on a cleaned glass plate left exposed for a short time. Flourishing colonies can be obtained in this way. They consist, naturally, of many different kinds.

Very patient examination of garments made from cellulose acetate fabric which have developed mould spots has brought to light the fact that there is a broken filament near the center of each spot. The precise significance of this is not yet clear. It may be interpreted as the result of destructive action on the cellulose acetate, but if such action were taking place it would not be expected to affect one filament only. The appearance suggests rather the result of mechanical action, for however carefully artificial-silk yarns are handled some filaments are certain to be broken. It is not impossible that these broken filaments are operative in the formation of the mould spots. Cellulose acetate is an electrical insulator standing high in the list of materials which can be electrified by friction. On agitation in air cellulose acetate becomes quite highly electrified. A broken filament is constantly moving about, and, by virtue of its low electrical capacity, it may attain a high potential. In this state it exercises a strong attractive force on particles of dust floating in the air. Mould-spots may possibly have their beginning in this way.

The subject is still under investigation. It may be that further work will prove that electrification of broken filaments has little or nothing to do with the question of mould growths. The suggestion is nevertheless an interesting one, worthy of attention, since it is the result of close observation.

Salesmen's Tournament

Al Alvarez of Grasselli Chemical Company again won the golf championship of the Chemical Industry at the annual tournament sponsored by the Salesmen's Association which was held at Briarcliff Lodge, Tuesday, September 15th. His score was 85. Second low gross prize went to C. S. Benjamin, General Chemical Company, with a 90, Robert Breuer, Atlas Refining Company, took third prize with a 93, and Vic Williams of Monsanto Chemical Works scored a 97 for fourth prize. There were lower scores than these last three but inasmuch as the individuals making them had won higher prizes in other competitions, they were not eligible for low gross trophies.

In the guests' low net, Rupert Lowe, Bakelite Corporation, scored a net 76 for first prize. S. L. Urban, E. R. Squibb, Inc., also had a 76 for second prize. D. S. Barnes took third with a net 79 and John Powell, John Powell & Company, won fourth prize with a net 86. R. J. Grant, Noil Chemical & Color Company and Harry Stebbins, Merck & Company, had the low net for members with 75; Grant taking first prize because of his lower handicap. S. C. Moody, Calco Chemical Company and William H. Adkins, Givaudan-Delawanna, tied at net 79, with third prize going to Moody on the handicap basis.

In the kickers' competition, Grant A. Dorland, MacNair-Dorland Company, had a net 73, which was the drawn number, and won first prize. B. J. Gogarty, American Solvents & Chemical Company, took second with a 75, W. I. Galliher, Columbia Alkali Company, won third and Ralph E. Dorland, Dow Chemical Company, took fourth.

Production and Uses of Cellulose Acetate*

By DR. HERBERT LEVINSTEIN

IT was in 1894—37 years ago—that Cross and Bevan (to whom is also due the invention on which is based the viscose rayon industry) took out the first patent for the preparation of cellulose acetate. The new product appeared to have some of the properties of collodion, and therefore to be capable of replacing this inflammable material for making plastics, films or threads, as the new acetate of cellulose had the great advantage over the older nitro body of being non-inflammable. Cross and Bevan's German patent was acquired by a wealthy German nobleman of high rank, Fürst Henckel von Donnersmarck, who also secured the patents of Weber, a chemist at that time working in Manchester, and later also of Lederer, to whom the present method of making acetate owes several important improvements.

It soon appeared, however, that the acetate produced under these patents, now generally called primary acetate, had many disadvantages. The films lacked toughness and stability, and after a time they became brittle and horny, while the only possible solvents, of which chloroform was the principal, were either toxic or, like epichlorhydrin, high boiling.

Nitrocellulose owes most of its industrial value to the fact that it dissolves, and is itself dissolved by, camphor, which forms an ideal plasticizer for this substance. On the other hand, the primary acetate seemed incapable of being incorporated with a suitable plasticizer to give a hard celluloid-like surface, for neither camphor nor any of the known camphor substitutes was of any use. In addition, the technical preparation of the acetate proved to be extremely difficult, and the cost of the product was at that time much higher than that of nitrocellulose. As these drawbacks could not at that time be overcome, the undertaking founded by Fürst Henckel von Donnersmarck lost a large amount of money over the venture.

Ten years later, in 1904, Miles, working in the laboratory of Dr. Little, a most distinguished New England chemist, well known in Great Britain, discovered the so-called "ripening" process, by which primary cellulose acetate was converted into what is now known as secondary cellulose acetate. Two years later Eichengrün, working in the Elberfeld laboratories of the Bayer concern, the great German dyestuff firm, applied for a patent for a process which led also to a secondary acetate.

The new product could be readily obtained as a white powder, was stable, easily soluble in cheap solvents, such as, for instance, acetone, and could be mixed with camphor substitutes—so-called plasticizers—to give films, plastic masses, or threads of sufficient tenacity, stability, and clarity.

The process of making cellulose acetate remains to-day substantially where Miles and Eichengrün brought it. Cotton linters are dissolved with good stirring and cooling in a mixture of acetic acid and acetic anhydride with a little sulphuric acid. When the cotton is completely dissolved a certain quantity of water is added and the material kept at a carefully controlled temperature until the conversion of "primary" (chloroform soluble) acetate to "secondary" (acetone soluble) acetate is completed. The mixture is then mixed with water. If this operation has been properly carried out the cellulose acetate is obtained as a white powder, which is washed and dried. The liquors, which contain the surplus acetic acid diluted with water, are concentrated and reconverted into the acetic anhydride which is required for the main operation, part being recovered also as glacial acetic acid or, if desired, as acetone.

The raw materials are thus essentially cellulose, in the form of cotton linters, and acetic acid, either in the glacial form or as the anhydride. One hundred parts of cellulose give over 160 parts of cellulose acetate because of the large proportion of acetic acid which enters the cellulose molecule in the course of the reaction. From this it is clear how very important in the production cost of cellulose acetate is the price of acetic acid.

Formerly acetic acid was obtained entirely from the distillation of wood, but in recent years several synthetic methods have been worked out. The first of them, which is being carried out in particular at Shawinigan Falls in Canada, where cheap power is available, uses calcium carbide as the raw material, the method, of course, depending on the formation of acetylene from the carbide, and the conversion of this acetylene, by a well-known catalytic reaction, first to acetaldehyde and then to acetic acid. The second method, which is being employed on a large scale at Hull by British Industrial Solvents Limited, a branch of the Distillers Company Limited,

*Times Trade and Engineering Supplement.

starts with molasses, which are converted by fermentation to alcohol, which can in its turn be converted into acetaldehyde and thence into acetic acid. There are other catalytic methods for making both acetic acid and acetic anhydride, of which I may mention particularly that used by the well-known German firm of Wäcke, of München, but none of the methods has yet attained the importance of the first two.

As a result of these new methods the price of both glacial acetic acid and anhydride is very much lower today than before the war, and the cost price of cellulose acetate is now nearer that of the nitro body. The difference appears likely to diminish further as time goes on if acetic acid, as seems not unlikely, continues to fall in price.

However, the problem of dyeing, now so brilliantly solved by British chemists, appeared to suggest at that time that acetate thread was definitely a textile fiber of minor importance. The atmosphere in recent years has been made thick with clouds of patents, the intrinsic value of which cannot be high, but the priority for the technical working out of the modern secondary cellulose acetate appears to belong to the Bayer concern.

In 1910 cellulose acetate dope was first applied in Germany to the wings of an aeroplane. This application of the new product, owing to the war, became of enormous importance.

Since the war great efforts have been made to find a use for acetate to keep employed the factories originally erected for war-time purposes. So far the manufacture of artificial silk has proved to be the largest outlet. Accurate figures are not available, but one may estimate the world's production of acetate silk at about 35 tons a day, and silk probably accounts for three-quarters of the acetate produced. After silk in importance come moulding powders, photographic and cinema films, splinterless glass.

One of the technical difficulties in utilizing acetate in the plastic industry lies in the selection of a suitable plasticizer. Camphor and nitrocellulose seem to have been born for each other. For whatever purpose ordinary celluloid is employed, camphor is a suitable plasticizer, but this is by no means the case with cellulose acetate.

Thin sheets of cellulose acetate are used as transparent wrapping paper, and have the advantage over the viscose type of transparent paper of being more water-resistant. Similar sheets are also used as insulators in the electrical industries, and much attention is being given to the preparation of special types of cellulose acetate for this purpose. The gold tip of a cigarette is made of cellulose acetate.

There has been incessant research for 37 years on the preparation of cellulose acetate, on the discovery of suitable solvents and plasticizers, and on its spinning, moulding, and dyeing. Nothing has been easy in this field; nothing has been achieved without the incessant labor of many workers. The reason is clear. The raw material cellulose is a most complex substance, the type that chemists call a colloid. Chemists have some mastery over substances which crystalize, whose atoms order themselves with military precision in symmetrical patterns. With colloids we are still in the dark, and that is why progress has been so slow; everything has had to be discovered empirically, theory lending but little aid.

Research Activities

The regular quarterly meeting of the Board of Directors of U. S. Institute, the monthly meeting of the Executive Committee and also of the Research Committee and Board of Trustees were held recently at the University Club, Boston. Attending these sessions were the following directors and research committee members: Dr. S. W. Stratton; D. F. Edwards, Pres., Saco-Lowell Shops; E. N. Hood, Treas., Pequot Mills, Alban Eavenson, Pres., Eavenson & Levering Co.; Prof. Louis A. Olney, Lowell Textile Institute; Dr. W. F. Edwards, U. S. Testing Co., Inc.; A. R. Mitchell, Jr., Allen R. Mitchell & Son; H. V. R. Scheel, Vice-Pres., Botany Consolidated Mills, Inc., Dr. E. H. Killheffer, Pres., Newport Chemical Works; Prof. H. J. Ball, Lowell Textile Institute; Prof. Geo. B. Haven and Prof. E. R. Schwartz of M. I. T.; C. H. Clark, Sec., U. S. Institute. Director Weston Howland, Treas., Warwick Mills, was represented by Gilbert Verney as his proxy, and Director W. Scott Libbey, Treas., W. S. Libbey Co., sent as his proxy J. M. Lurie.

Membership Expands

Among the new members elected at the morning session were the following: Contributing: American Woolen Co., New York City, represented by Claxton Monro, Chief Chemist; Arlington Mills, Boston, Mass., represented by Marland C. Hobbs. Annual: Bradford Dyeing Assoc., New York City, represented by H. E. Danner, Pres. and Treas., A. W. Butterworth, DeHaven Butterworth, Harry W. Butterworth, J. E. Butterworth and A. C. Freeman, of H. W. Butterworth & Sons Co., Philadelphia, Pa.; Warner Eustis, The Kendall Co., Boston, Mass.; Jos. C. Farber, The Friedman-Blau-Farber Co., Cleveland, Ohio; The Hart Products Co., New York City, represented by Ralph Hart.

U. S. Institute for Textile Research at the end of its first six months is still in a formative stage, but actual research work is in progress upon an important list of subjects through participating laboratories, and membership has expanded to a total of 133, including 2 life, 34 contributing and 97 annual members. As there has been little organized membership solicitation thus far this list reflects a greater research-mindedness in the textile industry than the ratio between this list and the total number of textile mills or manufacturers.

Modern Methods in Screen Printing*

THE application of colored patterns to woven materials by the aid of stencil plates is no new thing. As originally practiced the patterns are cut out of paper which has been previously rendered waterproof by a coating of wax or varnish. The paper stencil is laid on to the cloth, and the color paste painted through the openings in the paper by means of a brush, or, latterly, by means of an air-spray. But this method has many drawbacks. The paper stencils are lacking in durability, and, furthermore, they have to be cut in such a way that no detached pieces occur. Hence it is impossible to reproduce closed curves of any type. The designs have to be crossed at frequent intervals by bridges to support the central masses of the figures. Consequently, stenciled designs were forced to acquire a characteristic appearance all their own, somewhat suggestive of the structure of a stained-glass window, where the detached areas of color are supported by the leaded strips.

The Japanese found a method of overcoming this inherent defect of stencil designs by making their bridges of fine, natural-silk threads, which were glued in between two thicknesses of the stencil papers. From this it was but a step to the production of the modern stencil screens. These consist of a finely woven but open-meshed fabric made of silk, bolting cloth, acetate silk, or even wire gauze, which is tightly stretched over a light wooden frame. In other words, the complete stencil is a shallow wooden box without a lid, the bottom of which is formed by the stencil cloth. The pattern is formed by painting it on to the cloth with a resistant varnish of some kind, usually transparent, to allow the printer to see the underlying cloth through the screen, thus ensuring correct register with the pattern already printed.

The printing table resembles that used by hand-block printers. There is a level stone bed, over which is fixed a soft felt blanket. Over the blanket is stretched a sheet of oilcloth, and this may or may not be covered by a back grey to absorb superfluous color passing through the printed material. In the most modern outfits the felt is covered by an endless rubber blanket, which is led over suitable rollers at each end of the printing table, and is brought back underneath the table to the starting end. As the rubber blanket approaches this end of the table it is automatically painted over with a thin layer of adhesive, and then passes, together with the material to be printed, between two rollers, whereby the cloth and rubber blanket are made to adhere firmly together, thus avoiding any danger of pattern misfits due to uneven shrinkage or wrinkling. When the length of cloth has been printed it is drawn away from the rubber blanket and passes in festoons to the drying chamber, where it is subjected to currents of warm air till in a fit state to be batched up and taken away for further processing.

Many methods have been made use of for the actual production of the pattern on the stencil screens. The earliest was to draw the design on the tightly stretched screen with crayon, and then to paint round it with an impermeable varnish. A more modern method involves painting the actual design on to the screen with a soluble gum. After drying, the impermeable varnish is applied all over, either by painting or spraying, and when this has dried the screen is placed in water, when the design dissolves out and carries the overlying varnish away with it. For very fine designs, particularly in the case of a small repeat over a large stencil, this hand-painting becomes very laborious and expensive. The difficulty has been overcome in a very ingenious manner by photographic means. The whole screen is coated with a solution of gelatine containing a small proportion of potassium bichromate, which is carefully dried at a low temperature in the dark. A single repeat of the design is hand-painted on glass or transparent celluloid. If this transparency is pressed into contact with the gelatine-coated screen, and the surrounding areas covered by a non-transparent sheet of cardboard, on exposure to daylight the gelatine will become insoluble where the light has passed through the transparent areas of the print plate, whilst the shaded portions will remain soluble. When each section of the screen has been printed in this way the whole is immersed in warm water, when the unexposed portions of the gelatine readily soften and wash away, whilst those portions of the screen which have been exposed to light will remain coated with an impervious coating of insolubilized gelatine.

The actual operation of printing the fabric is very simple. The cloth is stretched over the full length of the table, and the position of the stencil frames marked out by stop-pins. It should be mentioned at this point that in preparing the stencil screens a 2-in. band of impervious varnish must always be left along the two sides of the screen which run parallel to the selvage of the cloth. The frame is placed in position, and a squeegee, made either of plain wood with a carefully bevelled edge, or fitted with a straight strip of rubber, is supported by the printer in an upright position inside the stencil frame in such a way that it stands on the inner edge of the afore-

*Textile Manufacturer.

mentioned impervious strip. There is thus formed a narrow trough about two inches wide between the edge of the frame and the squeegee. Into this an assistant pours a dose of the color paste. The printer moves his squeegee to the end of the box and pushes the pool of color paste right across the face ef the stencil to the other end. He lifts his squeegee over what is left of the color paste and proceeds to draw it back again to the starting end of the frame. In this way a perfectly even layer of the color paste is spread over the face of the stencil, and is forced through the meshes of the unprotected screen material on to the cloth underneath. The frame is then lifted and placed into the next position, already marked out for it by the following set of stops. A second printer at once occupies the vacated space with the screen for the second color of the design. The two printers can in this way cover a length of 60 yds. with 6 ft. by 4 ft. frames in fifteen minutes, and they can be followed two frames later by two more pairs of printers.

This method of printing can obviously not compete with roller machine printing in the case of large orders, where a machine can run continuously for a whole day on the same design. But where there is only a limited number of pieces in the order to one design, the saving in cost is very considerable, in spite of the reduced rate of output. In the first place there is no expensive printing machine to install, and no heavy capital outlay in the shape of engraved copper rollers. The preparation of a screen stencil does not involve the laborious and costly hand-work required in the production of a set of printing blocks, whilst on account of their lightness the area that can be covered at one impression is very much larger. Printing screens may be made up to 6 ft. by 8 ft., whilst the largest hand-printing block that a man can handle is not much more than 2 ft. by 3 ft. As regards the printing colors employed, these differ in no way, except in the nature of the thickening required, from those used in other printing methods. Strong alkaline mixtures must be avoided, on account of their deleterious action on the screen fabric. and the following formula gives an interesting modification of the typical vat-color print paste, whereby the danger of damaging the screen is reduced to a minimum:—

Vat-dye paste	5	grms.
Glycerin	10	"
Water	15	"
Potassium bicarbonate	20	"
Rongalite	10	"
Tragacanth 5%	40	"

At the temperature of the ager the bicarbonate will first of all lose CO_2 and become converted into potassium carbonate, and this will then react with the other ingredients of the color in the normal manner. Direct prints, discharges, resists, all are applicable, and owing to the speed with which the cloth can be covered there is not the same difficulty with regard to colors that have to be aged very soon after printing, as arises in the case of the much slower block printing.

A further advantage of the screen-printing process lies in the fact that the quantity of color to be applied can be controlled at will by the printer. A thin voile obviously does not require such a dose of color as a long-piled velvet, in which the whole depth of the pile has to be impregnated. In the case of block printing the additional color required has to be applied by a succession of impressions on the same spot, with the almost inevitable result of slightly blurred outlines. With the roller printing machine engravings have to be made deep or shallow, according to the nature of the cloth to be printed, so that it would be impossible to print the same design on a plain cloth and a plush without a change of rollers. In fact, a different set of rollers would be required for each different quality of cloth.

When using surface printing rollers this difficulty is not met with, for it is possible to ensure that sufficient color is applied in one impression by regulating the degree of saturation of the endless felt furnishers. But the cost of surface printing rollers is also very high, since the whole design has to be built up bit by bit by hand-work only, and that hand-work demanding the highest degree of skill. For the making of a stencil screen the artist can draw his design straight on to the screen fabric, whilst the blocking-out of the surrounding areas can safely be left to practically unskilled workers. The outlining of the individual figures of the design with a narrow brush requires a very sure and careful hand, after which the blanking-out with varnish of the larger remaining spaces offers no difficulty whatsoever.

Photography for Silks

A most interesting method of embellishing materials is said to have been made practical. This process is termed "Phototone," and is the newest and latest development of photography as applied to textiles. It requires no rollers, no screens and no blocks for printing. The material is impregnated with a sensitizing solution and used as a film to receive the printing.

The pliability of American dye materials, the manufacturers say, is making it possible to do this work in absolutely fast colors—fast to light and fast to washing —and when applied to such sturdy material as linen it is of incomparable value to the market.

Perhaps one of the most interesting uses of this process is its adaptability to reproduction of period designs of the old masters, described as bringing in the minutest detail of shading. It may also be used for photographing the newest view or the most thrilling woodland vista.

Its scope is claimed to be without limit, although at the moment it may be printed in only one color. Later, it is promised in multitone, which will increase both its interest and its usefulness. Robert McBratney & Company, Inc., of New York, is its sole distributor and the United States Finishing Company, its sole producer.

The Oxidation of Sulphur Blacks*

Acetic Acid Neutralization Essential

By GEORGE SARGENT

THE writer, after twenty-five years' experience of the vicissitudes of sulphur black dyeing, still finds snags in this process. The simple recipes and methods of dyeing in use convey a suggestion of facility not always borne out in practice. That the application of sulphur black is a matter of wide interest is proved by the fact that the consumption of black dyestuff is well maintained, even in this color-loving age.

The term "vat" used in connection with hydrogen-alkali-soluble dyes—indigoid and anthraquinone derivatives—is in some senses applicable to the solubilizing of sulphur blacks prior to and during the dyeing operations.

This can be roughly illustrated by treating a cutting of black cotton with warm hydrosulphite when the formation of a brownish color which re-oxidizes to black in air shows the color-change in the reduced dye-bath (sulphur black can, in fact, be dyed from a hydrosulphite vat) is similar to that known as the colored leuco stage of vat-dye reduction and application.

Not Fool-proof

This point is raised in order to stress its converse aspect, namely, that just as it is vitally important to secure uniform and adequate aging of indigo and other vat dyes to attain maximum shade-fastness, so in the case of sulphur blacks to regard the simple dyeing process as fool-proof, requiring only ordinary direct dyestuff after-treatment—a more or less perfunctory washing off—is to risk diminished fixation.

To understand this essential fact of the completion of development of the black after dyeing it is necessary to remember that the dye-bath contains soda ash. Rock-sulphide also contains an appreciable quantity of caustic soda (up to about 4 per cent by weight) and is itself of a caustic nature.

The absorption and adsorption of alkali by the cellulose complex is well exemplified in mercerizing and alkali is persistently retained after dyeing from a sulphur-black bath even after prolonged water-washing, so that a dyestuff-cellulose-alkali complex is often to be found in dyed material which has not been neutralized. Here, apparently, conditions will prevail which delay complete intra-cellular oxidation of the black within the fibre and under suitable circumstances will tend again to solublize, or re-vat, the black-lake sufficiently to make the color liable to bleed on to adjacent threads, to give rise to uneven dyeings, or to cause the threads to lose color-depth irregularly during scouring, worsted crabbing and kindred wet-processes. In the crab, the hot liquor is concentrated and the process is more searching to certain dyes than is the acidified cross-dye bath.

Sulphur blacks are generally advertised as requiring no chemical after-treatment. Some dyers have urged that after-chroming spoils the beauty of the shade and that air-oxidation produces the bloomiest hues. Also it has been shown, *apropos* the direct oxidation of sulphur to sulphuric acid in the tendering of sulphur-black-dyed materials, that certain metals and their compounds catalytically accelerate this degeneration of the cellulose, among them being copper, iron, chrome, and potassium chlorate. Experiments years ago on the effect of after-treatment on the development of acid in dyed cotton showed that (taking incubated acidity of metal-free black cotton as unity) copper-sulphate gave nearly four times, iron sulphate over three times and chrome only one and a half times more acid generation in a metal-treated black than where no metal was used.

Some dyers use chrome-aftertreatment for deadening the shade and securing, as some think, enhanced fastness. Certainly no great excess of chrome is necessary to encourage oxidation. It should be kept at a minimum and the writer has no reason to consider a chromed-black more prone to tender than an air-oxidized one, but, whatever the verdict is supported in various quarters, the writer is of opinion that the neutralizing action of hot acetic acid in acetic-chrome development, even today is not sufficiently stressed. He believes that efficient neutralization of the alkali in the cellulose-black lake-complex is essential whether or no after-chroming is the works-practice. The persistent alkali-vat condition is destroyed and the tendency to re-vat under storage conditions is inhibited.

Aggregation of Color Particles

The subsequent neutralization of the acidified dyed fibre does not again set up intra-cellular vat-conditions. Furthermore, it appears probable that the hot acidification tends to aggregate the dispersed color-particles in the internal fibre, increasing fixation, and by reducing the surface-area of the particles, decreases liability to the spontaneous development of sulphuric acid.

The proneness to tendering of the dyed fibre is present

*Dyer and Calico Printer.

even when all free sulphur is removed by extraction, but is, of course, very marked when the cruder, less pure dyestuffs are used. The epidemic of tendering some twenty years ago was abated before 1914 by the increased purity of the dyestuff. Blacks produced here during the rush of war-time exhibited the old tendency but modern British blacks are at least equal to the best pre-war ones as regards non-tendering. Indo Carbon black was a great step towards immunity in this respect, but in a competitive trade has always proved rather expensive.

A tendency of a certain type of black to bleed blue (noticed some years ago) was due to faulty intermediates and imperfect manufacture.

In warp-dyeing, the writer's belief is that the repeatedly-oxidized cotton black, as dyed under chain-warp conditions, shows a coarser color-aggregate than the black produced in the closed-type machinery of beam-dyeing, where ordinary washing-off seems to provide imperfect oxidation and the retention of vat-conditions in the fibre-cell.

This would mean that ball-warp dyed cotton would be less likely to tender than the beam-dyed black

"DRUFTING"

Fully neutralized (i.e., acidified black, subsequently treated with alkali) and oxidized sulphur black is immune from the uneven action known as "drufting," exposure of a dyed warp, for example, in a grey weft piece, to draughts or air-currents. This can happen in storage causing unlevel final dyeings from previously level dyed warps, by air action on the exposed selvedges and cuttle edges of stored goods, unfortunately only showing after piece-finishing.

Finally, the writer considers that the neutralization by acetic acid is an essential process in black-finishing, whether the goods are chromed off or allowed to complete their oxidation in air.

A practical illustration as to the difference in pigmentation between chain-dyed (open-bath style) and beam-dyed (enclosed-bath) sulphur black is afforded in the lining trade which calls for black warps woven with grey worsted filling and subsequently dyed with chrome-logwood black in the piece. On account of its mordanting property the sulphur-black warp feeds in the piece-dyeing-bath. It is found that the chain-dyed warp requires a considerably lighter shade of sulphur black than does the beam-dyed warp to arrive at the necessary final result in the cloth, i.e., without bursting or overloading the piece effect by excess of color in the cotton. This seems to prove a color-particle in the chain-black with a rougher, coarser aggregate than the beam-black which physically has a greater attraction for the chrome-logwood black lake.

Knowing Where Time Goes

The actual total operating time of any electric equipment using alternating current is shown by a time meter introduced by the General Electric Company. Within the meter is a synchronous motor, like that used in a G. E. Telechron clock, which operates while the circuit of the equipment is closed. This motor, through suitable gearing, drives a cyclometer five-digit counter, arranged to read in either hours or minutes.

Such a meter is especially valuable in checking piece-rate operation, particularly when idle-time credit is allowed in computing wages. A weekly reading of the meter shows how many hours the machine was in operation, and hence, by deduction, the number of idle hours.

Other applications to which the meter has been applied include the making of life tests of radio and other vacuum tubes, incandescent lamps, etc.

The meter is supplied on a pedestal for portable use, or with a threaded connection for permanent mounting on conduit. The meters are available for 110, 220 or 440 volts, and for 25, 50 or 60 cycles; but no one device has more tthan one voltage or frequency rating.

New Measuring Gage

An electric gauge which measures one one-hundred thousandth of an inch, and then magnifies that infinitesimal dimension 10,000 times so that the average workman may speedily and accurately read the result, has been developed by the general engineering laboratory of the General Electric Company.

The new gauge is suitable for almost any type of measurement, with certain changes in the setup. It may be used to measure outside dimensions of automobile wrist-pins, the inside dimensions of automobile cylinders, and the thickness of flat materials such as sheet steel or paper.

The gauge consists essentially of a contact point supported to move through a limited distance in the direction of measurement, say 0.0005". This movement causes a pointer to travel five inches over the scale of an indicating instrument. The 10,000-times magnification of movement is obtained by unbalancing a bridge circuit of four inductances. A 500-cycle alternator supplies power to a small transformer which, in turn, supplies power to the four inductances. Two of these are small coils in the electric gauge head, which is about 5 x 2½ x 1½ inches in size.

The inductance of these is varied by the movement of a pivoted steel lever armature, one end of which moves between the coils as the contact point on the other end conforms to the surface of the piece being measured. The contact point is in the gauge spindle, which is made to fit the work. The other two inductances of the bridge, together with the transformer and indicating instrument, are mounted in an indicating unit, 12 x 12 x 12 inches in dimensions, which is placed in easy view of the operator.

Theories on the Action of Soaps

By **BENJAMIN LEVITT, F.A.I.C.**

The conduct of soaps in solution is still controversial. This article discusses the various theories on the action of soaps. The use of soaps in silk boiling off is also discussed.

SOAPS are defined as metallic soaps of fatty acids. Ammonia soaps are practically the only non-metallic soaps.

Although sodium, potassium and ammonia soaps are the only varieties that are soluble in water, there is quite an array of metallic soaps that are insoluble in water, and consequently have no detergent or lathering properties. Lead, manganese and cobalt soaps are used as driers in paint and varnish manufacture. Aluminum and calcium soaps are used to thicken oils as are also magnesia soaps. Zinc stearate has some medicinal virtues and it is therefore used in talcum powders.

An Absorption Product

Merklen and Leimdorfer in 1906, characterized soap as not being a product of definite chemical composition, but rather as an absorption product, whose composition is dependent (1) on the nature of the fatty acids, (2) the composition of the nigre in the case of settled soaps, and (3) the temperature at which the soap was boiled. (The nigre is the dregs of the soap kettle, consisting of soap, lye and dirt.) The above description may be easily interpreted to mean that the uniformity of soap depends mainly on the skill with which the soap maker handles his kettle.

When soap is dissolved in cold water, it undergoes a decomposition, in which alkali is liberated in the form of caustic soda and the elements of water are absorbed. This change is known as hydrolysis. The following reversible reaction expresses the above in its simplest form:

$$2\,C_{17}H_{35}COONa + H_2O \rightleftharpoons C_{17}H_{35}COONaC_{17}H_{35}COOH + NaOH$$

Sodium Stearate + Water $\rightleftharpoons$ Acidsodium stearate + Caustic Soda

However, by actual measurement, it was found that only a small portion of the alkali in the soap is ever found free in solution. This action may be demonstrated by a simple experiment—place a drop of alcoholic phenolphthalein solution on the surface of a dry piece of soap. There is no color change. Wet another section of the same piece of soap with water, and then add a drop of the same indicator solution. A deep red coloration results at once, owing to the action of the liberated caustic soda.

The conduct of soap in solution is still controversial. Some of the early researches claimed that soap is a colloid, while other more recent investigators attribute both colloidal and crystalloidal properties to soap solutions. McBain is one of those who hold the latter theory. (Note: A colloidal substance is gellatinous in nature, which diffuses either very slowly or not at all through a membrane. A colloid scarcely affects the boiling point or the freezing points of its solution. Egg albumin, starch, silk are colloids. Crystalloids diffuse easily through animal membranes, raise the boiling point and lower the freezing point of their solutions. Salt, sugar, caustic soda are examples of this class of compounds.)

Colloidal Electrolytes

McBain and his associates claim that, since soap solutions are electrically conductive, pass moderately through membranes (osmotic activity), and at the same time exhibit colloidal properties, they should be called "colloidal electrolytes."

Before discussing how soap acts as a detergent, we should consider what constitutes the substance, namely, dirt, to be removed. There are as many theories regarding the nature of soil on fabrics as there are on the mechanism of washing. However, all theories except one, start from the premise that all dirt adheres to fabric or to the skin by means of a fatty film. It is only when this fatty film is removed that the dirt particles are loosened. The only other theory is that of Spring, who claims that the dirt forms a compound with the fabric surface and that the soap makes an even better soap-dirt combination, and so is removed from the surface. Credit must be given to Spring's theory because soiled spots are not always associated with oil films. For example, we may have dirt particles adhering to fabrics because of being previously

stained with some sticky substance that is entirely free from fat, such as sugar, molasses, glycerin or gelatin.

The greatest difficulty in the study of detergency thus far encountered, has been to make up a standard "soil," which may be given to various investigators so that they may be enabled to duplicate one another's results, by using a standard soap and standard method of washing. The standard soap and Launder-Ometer have been devised but the soil is yet in the offing.

Emulsification and Alkali Theories: The adherents to these, claimed that the detergent action is due to the fact that soap solutions emulsify oils. Thus the liberated alkali emulsifies the fatty matter by which the dirt particles cling to the fabric, causing them to be carried away mechanically.

Three More Theories

Brownian Movement Theory: When finely divided particles of matter are suspended in water, they are continually in motion. This is known as pedesis or the Brownian movement. It was found by Jevons in 1878 that soap markedly increases this action. This writer thought that the increased movements caused the dirt particles to be worked out of the fabrics.

Lubricant Theory: Some writers attribute to the lubricating quality of soap, the property of making the dirt less adherent, and so it may be removed with great facility.

Colloidal Theory: Due to the hydrolysis of soap, the colloidal acid soap bears a negative charge, while the dirt particles have been shown to carry a positive charge. A combination of acid soap-dirt particle ensues, resulting in a colloidal absorption compound. It has been shown that particles of lamp black from which all traces of oil had been extracted could be suspended for months in soap solutions of certain concentrations. This demonstrates the dispersing power of soap.

Since each experimenter can prove his pet theory by certain evidence, which is more or less contradicted by the experimental evidence of others, we believe that there are merits to each theory, and that if a combination of all the theories could be made, we might strike a happy medium which might reconcile the individual opinions, and we would probably have a true estimate of what goes on in the tub.

Just a few words on the action of soap in the silk soaking emulsion: Soap is used in the manufacture of silk for a somewhat different purpose than to scour. In the preparation of silk for throwing, it is first soaked in an emulsion made up of oil and soap. Olive oil and olive soap are the favorites for this purpose, although there is a considerable amount of neatsfoot oil also used for this process. To a 1 per cent solution of soap in a 60-gallon tub, about a pound of mild soda is added to give the solution little extra alkali. About one gallon of oil is added and the mixture is agitated thoroughly, until a good uniform emulsion results. This may be done with a small portable mixer or if the emulsion is made while part of the water is added to the bath through a syphon T, this will also give good mixing. The silk is soaked in this emulsion usually from late in the afternoon until the following morning.

It has been found that after soaking, the emulsion is less alkaline than at the start. This neutralization caused by the combination of sericin from the silk with alkali from the soap, seems to cause a breaking of the emulsion, to a certain extent. Hence the advisability of adding a little soda in making the emulsion to offset this effect.

Surface Tension Lowered

Soap causes a lowering of the surface tension so that the oil and the water go together more easily. In agitating, the oil is broken up into small particles which are at once surrounded by soap. The smaller the particles become the more permanent the emulsion remains.

Soap also acts as a lubricant, its unctuousness causes the silk to slip easily through the machine parts in throwing, and knitting. As it is hygroscopic, it helps hold the water, on the surface of the silk, thus imparting the quality of elasticity and softness.

Since the oil which has been used in soaking is held onto the surface of the thread in emulsion form, the oil is not so apt to agglomerate or stand on the surface in small beads and therefore there is less chance of its being scraped off in knitting. The fiber therefore remains soft and self lubricated.

Boiling off and degumming are processes by which the fiber is freed of all extraneous matter. The sericin together with the oils with which the silk has been treated in earlier stages are all removed, and the fibroin material remains free, lustrous and beautiful. These processes require a good soaping in which the soap must not be allowed to break down. The soap manifests itself in accordance with all the above theories, in the boil off bath.

Textile High School

Textile High School, New York City, announces the opening of the sixth year of its special day classes in silk and rayon merchandising and manufacturing. This course will be given at the new Textile High School recently erected and furnished with modern textile equipment at a cost of over three million dollars. The instruction is free, since it is under the Board of Education; the principal is Dr. William H. Dooley.

Design Registration

More than 1,400 textile designs for use on spring season fabrics were registered during August with the Textile Design Registration Bureau, affiliated with the Design Protection Association, an increase of 300% over August, 1930.

The Development of Mildew on Wool

(Continued from Page 632)

For goods during storage or transport the employment of antiseptics is expedient and work is being carried out to devise treatments which will give the desired protection for all classes of exported goods. The customary practice of dispatching goods in airtight containers is to be deprecated, for the stagnant conditions so produced favor the growth of fungi and occasionally bacteria by setting up localized areas of moisture condensation. By arranging the materials so as to allow a free circulation of air, and by adequate ventilation in ships' holds, the annual loss sustained on the ground of mildew would be considerably reduced.

[1] *See* Technique for the Microscopic Examination of Wool Fibers. R. Burgess and C. Rimington. "J. Roy, Micro, Soc.," 1929. **49**, 341-348. Quantitative Method for the Determination of "Soundness" in Wool and Cloth. C. Rimington. "J. Textile Inst.," 1930, **21**, T237-T244.

[2] The Inhibitory Action of Certain Substances on the Growth of Mould Fungi. R. G. Fargher, L. D. Galloway and M. E. Probert. "J. Textile Inst.," 1931, **21**, T254-T260.

[3] Subsequent work has shown that the use of *B* -naphthol is impracticable since, if mildew does occur, the wool develops undesirable odors and staining.

The Lubrication of Textile Fibres

(Continued from Page 614)

by Bennett[3] of rusting of cards will be found sound. In preliminary tests there is residual oil that protects the teeth of the card clothing, but in continuous running this protective layer would be lost. With present methods of scouring and knowledge of emulsification, it would seem entirely practicable to replace more of the olive oil with a mineral oil acidified with Red Oil to advantage, but under present conditions it would indeed be difficult to persuade a practical man that this would be a sane procedure. More and more, however, are the relations between different phases of matter being better understood, and as that of liquids in contact with solid surfaces is elucidated, lubrication in all its branches will be understood, and this will include the lubrication of wool.

References

[1] Levkowitsch—Chemical Technology of Oils, Fats and Waxes.

[2] Bennett—Wet Processes of Wool Manufacture.

[3] Ibid.

Cleansing Agents and Water Treatment

(Continued from Page 620)

sarily devoted largely to domestic trade. However, many of the products covered enter the export trade already in substantial quantities and with the growing adoption of new equipment and methods in foreign markets, promise to increase markedly.

Information of a statistical nature covering many of the above phases in greater detail can be procured on request to the Chemical Division.

New Patents

(Continued from Page 630)

Dyestuff Preparation and Process of Making Same. (Comprises oxidizing together on the fiber a mixture of the leuco compounds 1:2-naphthioindigo with symmetrical 2:1-naphthioindigo.) Adam Arbogast, of Basel, Switzerland, assignor to Society of Chemical Industry in Basle, of Basel, Switzerland, No. 1,818,878, August 11, 1931.

Direct Azo Dyes. (Dyeing cotton yellow shades fast to light and washing, obtained by combining 1-amino-4-(4'-nitrobenzoylamino-benzene-2-sulfonate with 1-sulfophenyl-3-methyl-5-pyrazolone.) Werner Lange, of Dessau-Ziebigk in Anhalt, Ger., assignor to General Aniline Wks., Inc., of N. Y., N. Y., No. 1,818,898, August 11, 1931.

New Vat Dyestuffs of the Dianthraquinonylamine-Carbazole Series. (Obtained, for example, by reacting alpha-alpha-diamino-1.1'-dianthraquinonylamine-carbazole with an anthraquinone beta carboxylic acid halide, dyeing cotton orange-yellow, yellowish-olive and olive-green to brown shades of good fastness.) Fritz Baumann, of Leverkusen-on-the-Rhine, Ger., assignor to General Aniline Wks., Inc., of N. Y., N. Y., No. 1,819,014, August 18, 1931.

New Vat Dyestuffs of the Benzanthrone Series and Process of Making Same. (Comprises acting with an acid condensing agent on a benzanthronyl-amino anthraquinone containing at least one aroylamino group in the anthraquinone residue, dyeing cotton yellow, brown, green and blue shades of excellent fastness.) Werner Zerweck and Ernest Honold, of Frankfort-on-the-Main-Fechenheim, Ger., assignors to General Aniline Wks., Inc., of N. Y., N. Y., No. 1,819,053, August 18, 1931.

Tetrakisazo Dye. (Obtained by coupling diazotized 2-Naphthylamin-6:8-disulfonic acid with formaldehyde bisulfite compound of aniline, further coupling with cresidine and reacting with carbonyl chloride. Dyes cotton reddish brown shades of excellent fastness to light, capable of being discharged.) Charles S. Dewey, of Hamburg, N. Y., assignor to National Aniline & Chemical Co., Inc., of N. Y., N. Y., No. 1,819,079, August 18, 1931.

Production of Trisazo Dyes. (Consists in coupling diazotized 2-amino naphthalene 4.8-disulfonic acid with alpha-naphthylamine, then with 1.7-Cleve's acid and finally with S acid. Dye cotton from a neutral or alkaline bath bluish gray to graying blue shades of good fastness to light and washing and capable of being discharged.) Charles Dewey, of Hamburg, N. Y., assignor to National Aniline & Chemical Co., Inc., of N. Y., N. Y., No. 1,819,080, August 18, 1931.

Nitrogen-Containing Vat Dyestuffs of the Naphthoylene-Diarylimidazol Series and Process of Preparing Them. (Produced by nitration, yielding products dyeing

cotton gray and olive green shades. Extension of U. S. Patent Nos. 1,588,451, dated June 15, 1926, 1,690,775, dated Nov. 6, 1928, and 1,765,662, dated June 24, 1930.) Wilhelm Eckert, of Frankfort-on-the-Main-Hochst, Ger., assignor to General Aniline Wks., Inc., of N. Y., N. Y., No. 1,819,082, August 18, 1931.

Water-Insoluble Azodyestuffs. (For example, material impregnated with 2:3-hydroxy naphthoyl-4-chloraniline and developed with bis-(4'-amino-phenol)-2.6-naphthylene diamine, yield on cotton yarn or usual substrata for lakes blue to bluish black shades of good fastness.) Richard Herz, of Frankfort-on-the-Main, and Max Schubert, of Frankfort-on-the-Main-Fechenheim, Ger., assignors to General Aniline Wks., Inc., of N. Y., N. Y., No. 1,819,096, August 18, 1931.

Manufacture of New Azo Dyestuffs. (A range of shades from red to claret to dark brown, produced on the fiber by dyeing and printing and also on substrata, of remarkable fastness to light, obtained by combining diazo compounds with bis-(2'hydroxy-3'-naphthoyl)-2.5-diamino-1.4-xylole.) Leopold Laska and Arthur Zitscher, of Offenbach-on-the-Main, Ger., assignors to General Aniline Wks., Inc., of N. Y., N. Y., No. 1,819,103, August 18, 1931.

Azo Dyestuff from Sulphoaryl-3-Carboxylic Acid Ester-5-Pyrazolones. (Dyeing wool red to yellow shades of excellent light fastness.) Heinz Eichwede and Erich Fischer, of Hochst-on-the-Main, Ger., assignors to General Aniline Wks., Inc., of N. Y., N. Y., No. 1,819,547, August 18, 1931.

Manufacture of Oil and Fat Soluble Azo Dyestuffs. (Obtained by coupling a tetrazotized diamino base from formaldehyde and meta-toluidine with unsulphonated azo components.) Adolf Krebser and Ernst Wysard, of Basel, Switzerland, assignors to "J. R. Geigy S.A.," of Basel, Switzerland, No. 1,819,957, August 18, 1931.

Azo Dyestuffs and Process of Making Same. (Direct gray dyeing colors of good fastness to light on cotton, obtained by coupling a diazo-compound with an aromatic primary amine coupling in 4-position to its amino-group, further diazotizing the monoazo dyestuff thus obtained, again coupling with an aromatic primary amine coupling in 4-position to its amino-group, then diazotizing the disazo-dyestuff thus produced, and coupling in acid, neutral or alkaline medium with 1-amino-5-hydroxy-naphthalene-7-sulphonic acid.) Bertram Mayer, of Basel and Joseph Grimmer, of Neuewelt, near Basel, Switzerland, assignors to Society of Chemical Industry in Basle, of Basel, Switzerland, No. 1,819,961, August 18, 1931.

Compounds of the Anthanthrone Series. (Intermediates and vat dyestuffs, dyeing cotton clear reddish-violet shades, obtained by reacting 2.7-dibromanthanthrone with nitrobenzene and potassium xanthogenate.) Rudolf Heidenreich, of Luverkusen-on-the-Rhine, and Werner Zerweck and Ernst Honold, of Frankfort-on-the-Main-Fechenheim, Ger., assignors to General Aniline Wks., Inc., of N. Y., N. Y., No. 1,820,019, August 25, 1931.

Acid Wool Dyestuffs of the Anthraquinone Series and a Process of Making Same. (Yielding shades varying from yellowish-red to greenish-blue, according to the auxochromic groups present in their molecule, obtained by connecting an amino-anthraquinone nucleus containing auxochromic groups with the methylene group of a benzyl residue by means of a sulfur bridge and introducing sulfonic groups at least into the said benzyl residue.) Georg Kalischer, of Frankfort-on-the-Main, and Ernst Honold, of Frankfort-on-the-Main-Fechenheim, Ger., assignors to General Aniline Wks., In., of N. Y., N. Y., No. 1,820,023, August 25, 1931.

Diazosalt Preparations for Dyeing and Printing. (Consist of 1.5-naphthalenedisulfonic acid diazonium salts of unsulfonated substituted aromatic amines. A division of application filed Dec. 24, 1925, issued Jan. 28, 1930, as Patent No. 1,744,903.) Ferdinand Keller and Karl Schnitzspahn, of Offenbach-on-the-Main, Ger., assignors to General Aniline Wks., Inc., of N. Y., N. Y., No. 1,820,024, August 25, 1931.

Azodyestuffs Insoluble in Water and Process of Making Same. (Of yellowish-orange, brownish-orange, yellowish-red shades, obtained by combining any diazo- tetrazo- or diazo-azo-compound not containing sulfonic or carboxylic groups with a dihydroxy quinoline compound.) Arthur Zitscher, of Offenbach-on-the-Main, and Robert Schmitt, of Darmstadt, Ger., assignors to General Aniline Wks., Inc., of N. Y., N. Y., No. 1,820,039, August 25, 1931.

Underdown Joins American Dyewood

Roy H. Underdown, who was Philadelphia representative of the former Heller & Merz Co. for twenty years, is now manager of the American Dyewood Company's Philadelphia branch.

As is well known, the American Dyewood Company is a leading manufacturer of extracts of logwood, hematine, fustic, quebracho and kindred products, and also operate, in conjunction with their affiliated company, the New York Color & Chemical Co., a plant manufacturing coal tar dyestuffs at Belleville, N. J.

Mr. Underdown's friends in the trade can reach him at the American Dyewood Company's Philadelphia headquarters which are located in the Public Ledger Building, 6th and Chestnut Sts.

Research Lack a Cause of Profitless Era

A. W. Zelomek, statistician-economist of the Fairchild Publications, who spoke at Board of Directors meeting of U. S. Inst. for Textile Research, stated that research is a part of the equipment of any industry, and textiles are no exception. "Lack of understanding of the markets that the textile industry is serving," stated Mr. Zelomek, "was probably one of the major reasons for the profitless era during the past decade, while industry in general was experiencing the most favorable earning period in its history. It will be absolutely essential that the various companies in the textile industry give greater heed to distribution research than they have done hitherto, for the industry could hardly go thru another ten years of a profitless era without dire results."

Mr. Zelomek emphasized the need for determining the potential output of a fabric or fabrics and correlating this information with the distribution or sales of these items. "The sales records of most organizations," stated Mr. Zelomek, "contain sufficient information to enable them to study this much more intelligently than is done at present. The industry has utilized very little of its own facilities which are available in its records." He also pointed out that the increasing production of all textile fibres, and the low prices of these items, will mean increasing competition not only between various fabrics of the same group, but among the various textile fibres. Therefore, the necessity for studying the movement of each industry in relation to the others is most essential. The concluding message left by Mr. Zelomek emphasized the fact that there was no need of setting up elaborate, complicated research departments, the cost of which would far exceed the values derived. He did, however, stress the need of knowing the movement of the various products.

The session devoted to marketing research was presided over by H. V. R. Scheel, vice-president of Botany Consolidated Mills, Inc., and chairman of the Institute's sub-committee on economic research. Among the other speakers was E. F. Gerish, Chief, Regional Division of Foreign and Domestic Commerce. This session, as well as the preceding visit to the textile laboratories of M. I. T., were open to all members and guests of U. S. Institute and were largely attended. U. S. Institute members were entertained at M. I. T. on invitation of Dr. Samuel W. Stratton, chairman of the Board of that institution and president of U. S. Institute.

Dr. Steik Changes

Dr. Karl T. Steik, recently of the Standard Oil Development Company, has been appointed Research Director at the new main laboratories of the National Oil Products Company at Harrison, New Jersey.

Dr. Steik needs but little introduction to the technical world. Graduating from Dorpat University, he continued his work at the University of Koenigsburg, Germany, being the recipient of medals in recognition of research work in the chemistry of oils. He holds a master's degree from Harvard University and a Ph.D. degree from the University of Chicago. Dr. Steik has been associate professor at the University of Wyoming and University of Florida. Leaving the University he joined the Sun Oil Company as research chemist and later the Standard Oil of Indiana. Subsequently he become affiliated with the Standard Oil Development Company of Elizabeth, New Jersey. Dr. Steik has long been associated with the oil industry and his talents are well known.

His appointment as Research Director of the National Oil Products Company's laboratories is in keeping with their ever widening research program. The National Oil Products Company has always maintained a progressive research policy and in securing the services of Dr. Steik it will be in a position to expand its technical cooperation with the industries.

Technical Notes from Foreign Sources

Logwood Black on Silk

G. Paesch-Faerber-Ztg. 66,596 (1930)—Two forms of this dyeing are distinguished: "par" black, in which the silk has been weighted to such a point as brings the debasted silk to its original weight, and "heavy" black, in which the silk has been weighted considerably beyond this point.

For par black, the silk, after debasting and rinsing, is worked for one hour in an iron mordant of 25° B., then rinsed, and soaped in a bath containing 10 g. of Marseilles soap per liter. It is then blued in a bath containing 40% of potassium ferrocyanide and 50% of hydrochloric acid on the weight of the goods. The silk is best first worked in the plain ferrocyanide bath, and the acid gradually added during continued working. (The blueing can be omitted without serious difference in the results.) The silk is then well washed, and treated for one hour in a hot gambier bath of 1° B. After rinsing, the material is dyed in a 20% bath of logwood extract containing 10 g. of Marseilles soap per liter. For deepening the tone, the dyed silk is passed through a bath of iron pyrolignate, rinsed, redyed in an old logwood bath, rinsed, and scrooped. A gain in weight of 20-23% is attained.

For heavy black, the silk is worked for two hours in an iron mordant of 28°-30° B., washed well, left for one hour in water at 60°-70° C., and then well centrifuged. This process is repeated twice. The goods are then soaped boiling hot with 50-60% of soap, until the silk has regained its luster; rinsed well, and blued as above, with 40% of potassium ferrocyanide and 50% of hydrochloric acid. The goods are then rinsed warm, treated in a hot catechu bath of 3° B., allowed to cool slowly in this bath, and left in it over night. After washing, the silk is dyed from warm to hot, with 100-150% of logwood. Rinsing and scrooping complete the process. The scrooping is carried out with a bath of oil emulsified with ½% of soda, to which has been added 2% of acetic acid. The increase in weight amounts to 30-35% over "par."

Charles J. S. Fraser

Charles J. S. Fraser, managing director in America for Wm. Hollins & Company, Inc., of Nottingham, England, died suddenly on Sunday, September 20th. He had been in apparent good health.

Mr. Fraser came to the United States from Scotland where he had spent five years in the Glasgow office of Wm. Anderson Textile Mfg. Co., Ltd. He served in the capacity of sales manager from 1901 until 1916, when he joined the British War Mission. In 1919, Wm. Hollins & Company, Ltd., opened American offices and Mr. Fraser became managing director, in which position he served until the time of his death.

Mr. Fraser was an expert on textiles and was well-known and highly regarded in the trade.

1932 Spring Shoe and Leather Colors

Nine high style colors and five classic staple shades for women's shoes will appear on the 1932 Spring Shoe and Leather Card to be issued shortly by the Textile Color Card Association, it was announced recently by Margaret Hayden Rorke, managing director. Confidential advance swatches of the high style shades have just been sent out to the Association's members in the shoe and leather industry.

These official colors, which will receive wide promotion for the Southern resort and 1932 Spring and Summer seasons, were selected by the joint color committee of the Tanners' Council of America, the National Boot & Shoe Manufacturers Association and the National Shoe Retailers Association, in cooperation with the Textile Color Card Association.

New Technical Department

The National Oil Products Company of Harrison, N. J., refiners of industrial oils, has organized a new technical department to work in collaboration with the sales department in the dissemination of helpful technical and scientific data received from the Nopco laboratories. Logan Grupelli has been named to head this new department by C. P. Gulick, treasurer of the National Oil Products Co. Mr. Grupelli, a graduate of Lafayette College, was formerly a member of the research staff of the American Cyanamid Company of New York.

The rate for "Position Wanted" advertisements in this column is 2 cents a word—with a minimum of 50 cents per insertion. For all other types of advertisements—i.e., help wanted, machinery or supplies for sale—the rate is $5.00 per column inch or less per insertion.

WANTED

Man fully experienced in color matching, Dye-testing and Standardization by a Dyestuff Manufacturing Co. Should be familiar with the different classes of Dyestuffs and their application to miscellaneous fibres. A day graduate of a recognized textile school is preferred. Give full details as to experience, reference, alary expected, etc. Reply to Box 698, American Dyestuff Reporter, 440 Fourth Avenue, New York, N. Y.

SALESMAN WANTED

A leading manufacturer of coal-tar dyes has an opening for an exceptionally able man possessing sales experience and the ability to work himself into the confidence and respect of paper mill executives. Thorough knowledge of dyes and their application to various grades of paper essential. Full details should be furnished, stating experience and present connection. All correspondence will be treated in confidence. Address Box No. 690, American Dyestuff Reporter, 440 Fourth Avenue, New York, N. Y.

DYE FOREMAN WANTED

with practical experience dyeing and finishing rayon and mixed fabrics to be employed as traveling adjuster with trade. Give age, personal history, and past experience. Address Box No. 691, American Dyestuff Reporter, 440 Fourth Avenue, New York, N. Y.

POSITION WANTED

DYER—Six years' experience at bleaching and dyeing wool, cotton, jute and union raw stocks and yarns. Thoroughly experienced in all stages of carpet manufacture. Age, 26; married. Address: Classified Box No. 692, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

POSITION WANTED

Dyer—cotton, piece rayon and mixtures. Any class of colors. Specialist on vats, reduced or unreduced process, Ice Napthols, immediate results, no new machinery. Large experience. Address Box No. 695, c/o American Dyestuff Reporter, 440 Fourth Avenue, New York, N. Y.

FOREMAN DYER

Extensive experience in piece dyeing and printing. Formerly connected with two of the largest dyeing and printing plants in the country. Cotton, wool, silk, celanese, rayon, etc. Regular and fast dye. Possessor of laboratory experience. Satisfactory references. Address Box No. 696, American Dyestuff Reporter, 440 Fourth Avenue, New York, N. Y.

POSITION WANTED

Experienced boss dyer on heavy quality Canton crepe, mixed goods, rayon, celanese, and tin-weighted silk. References furnished. Box No. 697, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.